

USER MANUAL

TTU02-MUX

*Fractional T1,
2 or 4 Port Multiplexer*



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WARNING:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause harmful interference in which case the user will be required to correct the interference at his own expense. NOTICE: (1) The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. (2) Shielded interface cables and AC power cord, if any, must be used in order to comply with the emission limits.

CISPR PUB.22 Class A COMPLIANCE:

This device complies with EMC directive of the European Community and meets or exceeds the following technical standard. EN 55022 - Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment. This device complies with CISPR Class A.

WARNING:

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

CE NOTICE

Marking by the symbol CE indicates compliance of this equipment to the EMC directive of the European Community. Such marking is indicative that this equipment meets or exceeds the following technical standards:

EN 55022:1994/A1:1995/A2:1997 Class A and EN61000-3-2:1995, EN61000-3-3:1995 and EN50082-1:1997

CTC Union Technologies Co., Ltd.

Far Eastern Vienna Technologies Center

(Neihu Technology Park)

9F, No. 60, Zhouzi Street, Neihu, Taipei, Taiwan

Phone:(886) 2.2659.1021 Fax:(886) 2.2799.1355

E-mail: info@ctcu.com <http://www.ctcu.com>

TTU02-MUX 4 Port MUX, Fractional T1(DS1), Installation and Operation Manual

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This manual supports the following models:

TTU02-MUX.2-XX-AC, 2 Port MUX, universal AC

TTU02-MUX.4-XX-AC, 4 Port MUX, universal AC

TTU02-MUX.2-XX-DC, 2 Port MUX, DC model

TTU02-MUX.4-XX-DC, 4 Port MUX, DC model

Important Update Notice

Commencing with production of the TTU02-MUX in March 2000, the Sub T1 Link has become an option. To incorporate this feature, firmware changes were made that moved the MAIN T1 link from the interface card to the mother PCB and SUB T1 link from the mother PCB to the interface card. Changes were also made to the unit back panel graphics to reflect the new positions. Note that on all new production, the Main T1 is below the Sub T1. The unit may now be ordered without the Sub T1 feature if it is not required. While referring to the manual for the TTU02-MUX, please note these differences in graphics and table settings for any older models.

June 2004 notice: As of this printing, the sub-T1 is now a standard feature on all models.

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CHAPTER 1. INTRODUCTION

1-1. INTRODUCTION

The **TTU02-MUX** provides an economical multiplexing solution for T1(DS1) and Fractional T1(DS1) network services. Up to two (or four depending on model) DTE devices may be linked to a **TTU02-MUX** at data rates of 56Kbps to 1544Kbps. The **TTU02-MUX** also has a provision for one optional T1(DS1) sub-link, which may be connected over a public T1(DS1) network. The T1(DS1) sub-link will perform Drop & Insert with user-defined timeslot connections from a PABX or other T1(DS1) equipment to T1(DS1) network services.

The **TTU02-MUX** supports local control and diagnostics via the LCD display, keypad and LED status indicators located on the front panel, via the serial console port connection or via the optional Ethernet SNMP port. The optional SNMP port provides SNMP Simple Network Management Protocol System functions, which allow the user to remotely control and diagnose the system. These features enable users to easily configure the unit, execute the in-service diagnostics and monitor the network status either locally or remotely.

1-2. FUNCTIONAL DESCRIPTION

The **TTU02-MUX** data channels support user-selectable transmission rates, which are integer multiples of 56 or 64kbps, up to a maximum 1.544Mbps, for a line attenuation of up to 36 dB on twisted pair cable. An integral LTU is included, providing an approximate operating range of up to 655ft. (using 22AWG).

The **TTU02-MUX** packs the data channels into T1(DS1) link time slots in user-selected time slots. The unused time slots may insert IDLE code.

The **TTU02-MUX** has eight types of user-replaceable data channel modules, which include: RS-232, V.35, X.21, RS-530/V.36, 10BaseT Ethernet Bridge, Voice and G.703 64K Co-directional. Additionally, RS-449 is supported via an adapter cable attached to the RS-530 interface module.

The **TTU02-MUX** fully meets all of the T1(DS1) specifications including ITU G.703, G.704, G.706, G.733, G.824, AT&T TR-62411, and ANSI T1.403.

The **TTU02-MUX** features V.54 diagnostic capabilities for performing local loopback and remote digital loopback. The operator at either end of the line may test both the **TTU02-MUX** and the line in the digital loopback mode. The loopback is controlled by LCD menu selection, serial control port, SNMP or by the DTE interface for V.35, RS-232 and RS-530.

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During loopback testing an internal pseudo random test pattern may also be generated, according to ITU-T, for direct end-to-end integrity testing. The Error indicator flashes for each bit error detected.

Multiple clock source selection provides maximum flexibility in connecting both the T1(DS1) and user interfaces. The T1(DS1) link may be clocked from the T1(DS1) recovered receive clock (main T1(DS1) link or sub T1(DS1) link), from any one of the user data ports, or from the internal oscillator.

The **TTU02-MUX** has following master timing modes:

- MAIN LINK: Timing is recovered from the main T1(DS1) link.
- SUB LINK: Timing is recovered from the T1(DS1) sub-link
- INT OSC: Timing is provided by the internal oscillator of the **TTU02-MUX**.
- CH1 LINK: Timing is recovered from the Data Channel 1.
- CH2 LINK: Timing is recovered from the Data Channel 2.
- CH3 LINK: Timing is recovered from the Data Channel 3.
- CH4 LINK: Timing is recovered from the Data Channel 4.

The **TTU02-MUX** data channel interface has four clocking modes:

- Mode 1 (DCE): DCE interface. The **TTU02-MUX** provides the transmit and receive clocks to the user's equipment connected to the data channel.
- Mode 2 (DTE 1): DTE interface. The **TTU02-MUX** data channel accepts the user transmit clock and provides a receive clock (Recovered timing) to the user's equipment connected to the data channel.
- Mode 3 (DTE 2): DTE interface. The **TTU02-MUX** data channel accepts the user transmit clock (from ETC pin) and receive clock (from ERC pin) provided by the user's equipment connector to the data channel. The Mode 3 (DTE 2) is not available on channels with X.21 interface.
- Mode 4 (DTE 3): DTE interface. The **TTU02-MUX** data channel accepts the user transmit and receive clock (All from ETC pin) provided by the equipment connector to the data channel.

The **TTU02-MUX** operates from 90VAC ~ 250VAC, with models available for +24 and -48VDC. The unit is built in a single unit EIA compliant 19" rack mountable case (with optional mounting kit) that may also be placed on desktops or shelves.

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1-3. TYPICAL SYSTEM APPLICATIONS

In a typical application (Figure 1-1), the **TTU02-MUX** is used to connect the synchronous data channels of two host computers and the local and remote LANs over a T1(DS1) line. The connected LANs must remain on the same segment, as the Ethernet module does not provide a routing function.

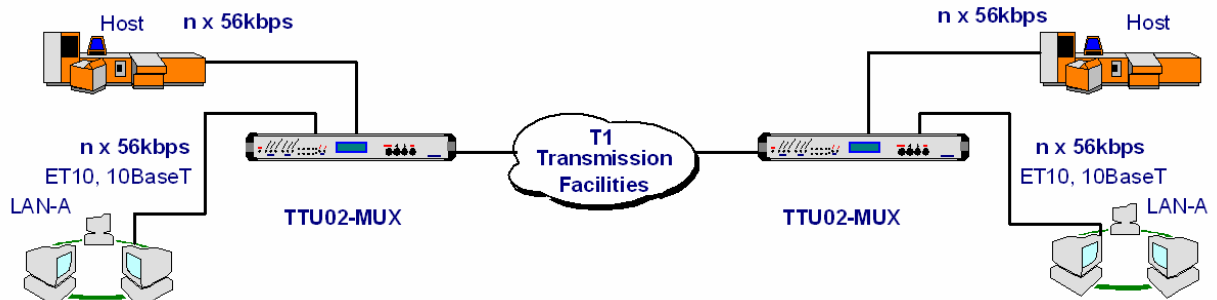


Figure 1-1: Example 1; Two Channel Typical Application

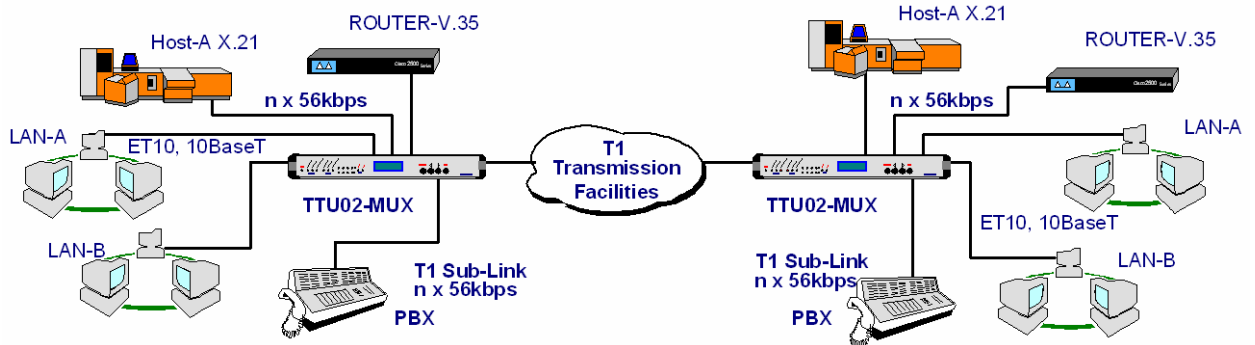


Figure 1-2: Example 2; Four Channel plus T1(DS1) Sub-Link Application

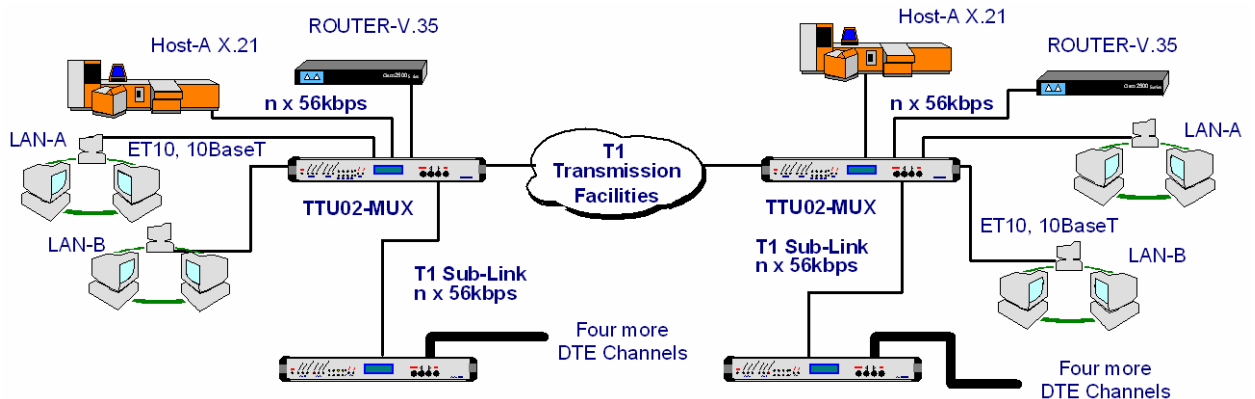


Figure 1-3: Example 3; Cascade TTU02 from T1(DS1) Sub-Link Application

The fractional T1(DS1) data service is based on the assumption that the combined user data rate of all channel modules plus Sub-Link is equal to or is a fraction of the full available T1(DS1) bandwidth, in multiples of 56K or 64K. Up to four data channels may be connected ($TTU02-MUX/4$, two for the $TTU02-MUX/2$) plus an optional T1(DS1) sub-link (drop and insert).

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1-4. T1(DS1) signal structure

The T1(DS1) line operates at a nominal rate of 1.544Mbps. The data transferred over the T1(DS1) line is organized into frames, with each T1(DS1) frame containing 193 bits. The 193 bits are organized as 24 time slots of eight bits each that carry the data payload plus an F-bit.

T1(DS1) transmissions utilize two main types of framing: **Super Frame** (SF or D4) and **Extended Super Frame** (ESF). Framing is necessary in order for equipment receiving the T1(DS1) signal to be able to identify and extract the individual channels.

Super Frame format (SF)

A super frame consists of twelve consecutive frames. The SF format is a structure in which the F bits are used for framing only. In the SF format, the F bits are divided into two groups:

Terminal Framing (Ft) bits that are used to identify frame boundaries.

Signaling Frame (Fs) bits that are used to identify super frame boundaries. When the 192-digit time-slots are DS0-channelized, the Fs bits are also used to identify the signaling frames.

Extended Super Frame format (ESF)

An extended super frame consists of twenty-four frames. The ESF uses the F bits for the following functions:

A 2-kbit/s frame pattern sequence (FPS): The FPS is used to identify the frame and the extended super frame boundaries. When the 192-information-digit time-slots are channelized, the FPS is used to identify the signaling frames.

A 4-kbit/s data link (DL): The ESF DL is for carrying performance information and control signals.

A 2-kbit/s cyclic redundancy check (CRC) channel: This channel carries a CRC-6 code.

T1(DS1) line signal

The basic T1(DS1) line signal is coded using the **Alternate Mark Inversion** (AMI) or **B8ZS** rule.

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In the AMI format, "ones" are alternately transmitted as positive and negative pulse, whereas "zeros" are transmitted as a zero voltage level. AMI is not used in most 1.544Mbps transmissions because synchronization loss occurs during long strings of data zeros.

In the B8ZS format, a string of eight consecutive zeros is replaced with a substitute string of pulses containing an intentional bipolar violation. The B8ZS code substitutions provide high pulse density so that the receiving equipment is able to maintain synchronization with the received signal.

1-5. *TTU02-MUX* Capabilities

T1(DS1) link line coding

The *TTU02-MUX* supports two T1(DS1) line codes:

AMI coding.

B8ZS coding.

T1(DS1) framing formats

The *TTU02-MUX* supports three formats:

Unframed format.

SF (D4) format.

ESF format.

User data channel rates

The *TTU02-MUX* supports user data channel rates which are a multiple of 56 or 64kbps. For maximum flexibility, the *TTU02-MUX* supports data rates up to 1.544Mbps. The *TTU02-MUX* supports flexible time slot assignment, allowing the user to freely specify the selection of time slots for each data channel.

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User data channel interface

The **TTU02-MUX** has eight types of user data channel modules: RS-232, V.35, X.21, RS-530, 10Base-T Ethernet Bridge, Voice and G.703 64K Co-directional. The **TTU02-MUX** also supports RS-449 data channel via an interface adapter cable attached to the RS-530 channel module. The desired interface is achieved by installing the appropriate type of channel module in the **TTU02-MUX**. The **TTU02-MUX/2** supports two data channel modules, while the **TTU02-MUX/4** supports up to four channel modules. For maximum flexibility, the **TTU02-MUX** supports data rates in multiples of 56Kbps or 64Kbps up to 1.544Mbps. The **TTU02-MUX** supports flexible time slot assignment, allowing the user to specify the selection of time slots in sequence or randomly.

System Timing Considerations

The **TTU02-MUX** has the flexibility to meet the timing requirements of various system configurations. The timing mode for the T1(DS1) link and for the user channel are selected by the setting of configuration data via the front panel LCD display, serial terminal console port, or via option SNMP management Ethernet port connection.

T1(DS1) link timing

The **TTU02-MUX** T1(DS1) link receive path always operates on the receive clock. The **TTU02-MUX** recovers the receive clock from the received T1(DS1) link data signal. The source of the **TTU02-MUX** T1(DS1) link transmit clock can be selected by the user.

The following T1(DS1) link transmit timing modes are available.

- **Loopback timing:**

The **TTU02-MUX** T1(DS1) link transmit clock is locked to the recovered receive clock (Main link T1(DS1) or Sub link T1(DS1)). This is usually the timing mode selected for network operation.

- **Internal timing:**

The **TTU02-MUX** T1(DS1) link transmit clock is derived from the internal clock oscillator. This timing mode is necessary in point-to-point applications over leased line. In this case, one **TTU02-MUX** must use the internal oscillator, and the other(s) must operate from the recovered clock.

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- **External timing:**

The **TTU02-MUX** T1(DS1) link transmit clock is locked to the clock signal provided by the user DCE connected to one of the user's data channels. When the data channel is used as the clock source, the data channel must use clock timing mode 2 (DTE1) or 4 (DTE3).

User data channel timing

The **TTU02-MUX** has four user data channel clocking modes:

- **Clock mode 1 (DCE):**

The **TTU02-MUX** data channel operates as a DCE and provides the transmit and receive clocks (recovered timing) to the data terminal equipment connected to the user channel. The clocks are locked to the master timing.

- **Clock mode 2 (DTE 1):**

The **TTU02-MUX** data channel supplies the receive clock to the synchronous DCE, and accepts a transmit clock from the DCE (from the ETC pin). The DCE must transmit data at the rate of the clock signal supplied by the **TTU02-MUX**. (This mode is also referred to as "transparent" timing.)

- **Clock mode 3 (DTE 2):**

The **TTU02-MUX** data channel operates as a DTE and accepts both transmit clock (from the ETC pin) and receive clock (from the ERC pin) from the user equipment.

NOTE: The X.21 data channel cannot be operated in clock timing mode 3 (DTE2).

- **Clock mode 4 (DTE 3):**

The **TTU02-MUX** data channel operates as a DTE and accepts both transmit clock and receive clock (both from the ETC pin) from the user equipment.

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1-6. TECHNICAL SPECIFICATIONS

Main link T1(DS1) and sub link T1(DS1)

Framing	-Unframed/Framed -SF(D4) / ESF
Bit Rate	1.544 Mbps
Line Code	-AMI -B8ZS
Line Impedance	-Balanced 100 ohms
Relative Receive Level	0 to -36dB
"Pulse" Amplitude	-Nominal 3.00V \pm 20% for 100 ohms
"Zero" Amplitude	\pm 0.15V
Transmit Frequency Tracking	
Internal Timing	\pm 30 ppm
Loopback Timing	\pm 50 ppm
External Timing	\pm 100 ppm
Jitter Performance	According to ITU-T G.824
Complies With	ITU-T G.703, G.704, G.706 and G.733, AT&T TR-62411 and ANSI T1.403
Interface Connectors	-15-pin, D-type Female -RJ-45

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User Data Channels

Interfaces Type	-V.35 -X.21 -RS-232 -RS-530/V.36 -RS-449 (via adapter cable) -10Base-T Ethernet Bridge -10/100Base-TX Ethernet Bridge -G.703/64k Co-directional
Interface Connectors	
V.35 Interface	34 pin, Female
X.21 Interface	15 pin, D-type Female
RS-232 Interface	25 pin, D-type Female
RS-530 Interface	25 pin, D-type Female
RS-449 Interface	37 pin, D-type Male(via adapter cable)
10Base-T Interface	RJ-45
10/100Base-TX I/F	RJ-45
G.703/64K Interface	15 pin, D-type Female
Line Code	NRZ (except G.703/64K, Co-directional line code)
Data Rate	n×56kbps or n×64kbps where n equal 1 to 24 in SF(D4) or ESF
Clock Modes	
Clock Mode 1 (DCE)	Receive and transmit clock (recovered) to the synchronous DTE
Clock Mode 2 (DTE1)	Receive clock to the synchronous, and transmit clock from the synchronous device
Clock Mode 3 (DTE2)	Receive and transmit clock from the synchronous DCE (from ETC and ERC pin)
Clock Mode 4 (DTE3)	Receive and transmit clock from the synchronous DCE (all form ETC pin).
Control Signals	-CTS constantly ON or follows RTS -DSR constantly ON, except during test loops -DCD constantly ON, except during signal loss
Time slot allocation	User defined

Ethernet interface

Compliance	IEEE 802.3
Interface type	10BaseT for use on UTP and STP media
Data rate	10Mbps (20Mbps/10BaseT in full duplex topology)
Interface Connectors	2-8 pin, RJ-45 (10Base-T straight, crossover)
LAN table	10,000 MAC address /w 5 second automatic aging
Filtering and Forwarding	15,000 frames/sec
Buffer	256 frames
Delay	1 frame

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G.703 64K Co-directional interface

Compliance with	ITU-T G.703
Line code	64Kbps Co-direction line code
Line	4 wires, one symmetric pair for each direction
Interface Connectors	15 pin D-type female
Range	Up to 800 meters (0.5 miles)
Impedance	120 ohms
Peak voltage of a "mark" (pulse)	Nominal 1.0V±10%
Peak voltage of a "space"(no pulse)	0V ±0.10V
Single pulse width	Nominal 3.9us
Double pulse width	Nominal 7.8us
Clock frequency	64 Kbps
Frequency tracking	±100ppm
Frame format	Unframed only

Setup/Configuration

LCD	2 rows of 16 characters
Pushbutton Switches	-Menu/ESC -Left Arrow -Right Arrow -Enter

LED indicators

PWR	Green	Power
Red Alarm	Red	T1(DS1) link signal loss
Sync Loss	Red	T1(DS1) link sync loss
Yellow Alarm	Red	T1(DS1) link Remote alarm
Red Alarm	Red	Sub-T1(DS1) link signal loss
Sync Loss	Red	Sub-T1(DS1) link sync loss
Yellow Alarm	Red	Sub-T1(DS1) link Remote alarm
CH1~CH4	Yellow	RD/TD activity indicators for Data Channels
Error	Red	Bit errors
Test	Red	steady ON; Unit in Loopback or BERT pattern test on flashing; Unit in Loopback from remote unit

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Diagnostic tests

Test loops

- Main link local analog loopback
- Main link local digital loopback
- Main link Payload loopback
- Main link In-Band LLB
- Main link Out-Band LLB
- Main link Out-Band PLB
- Sub link local analog loopback
- Sub link local digital loopback
- Sub link local Payload loopback
- Sub link In-Band LLB
- Sub link Out-Band LLB
- Sub link Out-Band PLB
- User's channel (1-4) local analog loopback
- User's channel (1-4) local digital loopback

BERT test pattern

- 511
- 2047
- 2¹⁵-1
- 2²⁰-1
- QRSS
- 2²³-1
- All ones
- All zeros
- ALT
- Double ALT (11001100....)
- 3 in 24
- 1 in 16
- 1 in 8
- 1 in 4

RS-232/Alarm port

Port interface

V.24/RS-232 asynchronous

Port connector

9 pin D-type female

Data rate

300, 1200, 2400, 4800, 9600, and 19200 bps

Data format

- One start bit
- 8 data bits
- No parity
- One stop bits

Alarm relay

- Floating pair of NO and NC contacts
- Contact ratings: 1A at 30 VDC resistive
or 0.5A at 125 VAC resistive

Physical

Height:

45 mm

Width:

430 mm

Depth:

235 mm

Weight:

3.5 kg

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Power supply

Voltage	90 ~ 250 VAC +24 or –48VDC (optional models)
Frequency	47 to 63 Hz for AC power
Power consumption	15 Watts
Fuse	0.5A slow blow for VAC

Environment

Temperature	0-50C / 32-122F
Humidity	0 to 90% non-condensing

CHAPTER 2. INSTALLATION

2-1. GENERAL

This chapter provides detailed instructions for mechanical installation of the **TTU02-MUX**. Following the completion of installation, please refer to Chapter 3 for front panel operating information and Chapter 4 for serial console port operating information.

2-2. SITE PREPARATION

Install the **TTU02-MUX** within reach of an easily accessible grounded AC outlet. The outlet should be capable of furnishing 90 to 250 VAC. Allow at least 10cm (4 inch) clearance at the rear of the **TTU02-MUX** for signal lines and interface cables.

2-3. MECHANICAL ASSEMBLY

The **TTU02-MUX** is designed for tabletop, shelf or rack mount installation, and except for rack mount installation, is delivered completely assembled. Rack mounted applications require installation of additional rack mounting "ears". No provisions are made for bolting the **TTU02-MUX** to a tabletop.

2-4. ELECTRICAL INSTALLATION

2-4-1. Power connection

AC power is supplied to the **TTU02-MUX** through a standard IEC 3-prong plug. (Refer to Figure 2-1) The **TTU02-MUX** should always be grounded through the protective earth lead of the power cable. The line fuse is in an integral-type fuse holder with the IEC power connector located on the rear panel. Make sure that only fuses of the required rating are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the power cable before removing or replacing the fuse.

2-4-2. Rear panel connectors

The data channel module interfaces install into the rear panel from inside the **TTU02-MUX** (Refer to Figure 2-1) and consist of a DB15pin connector for X.21 and G.703 64K, DB25pin connector for RS-530 and RS-232, 34-pin MB34 connector for V.35, and 8pin RJ-45 connectors for the Ethernet interface. The T1(DS1) line and T1(DS1) sub-link connectors incorporate one DB15pin and one RJ-45 connector each. (Appendix B provides detailed information on the various interface connectors).



Figure 2-1 **TTU02-MUX** rear panel

CHAPTER 2. INSTALLATION

T1(DS1) Line side

DB-15 Connector

The pin assignments for DB-15 connector are as follows:

Pin:	Function:
1	TTIP (Transmit data out)
9	TRING (Transmit data out)
3	RTIP (Receive data in)
11	RRING (Receive data in)

RJ45 connector

The RJ45 connector provides the same function as the T1(DS1) line DB15 connector. Refer to Appendix B for details.

Data channel modules

V.35 interface module

Utilizes standard pin-out. The three test pins have been chosen for loops and test. For applications using an V.35 interface, clock mode is selected DTE2, connect the ERC input clock to pins Z(A) and BB(B).

X.21 interface module

For applications using an X.21 interface external clock (Clock mode select DTE1 or DTE3), connect the input clock to pins 7(A) and 14(B) of the DB15-pin connector.

RS-530 interface module

Utilizes standard pin-out on a DB25-pin connector. The three test pins have been chosen for loops and test. For applications using an RS-530 interface, clock mode is selected DTE2, connect the ERC input clock to pins 20(A) and 23(B).

RS-232 interface (Sync) module

Utilizes standard pin-out on a DB25-pin connector. The three test pins have been chosen for loops and test. For applications using an RS-232 interface, clock mode is selected DTE2, connect the ERC input clock to pins 20. The RS-232 maximum clock rate is 128Kbps.

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RS-449 interface module

Appendix B-5 describes the cabling connection between the RS-530 interface and the DB37-pin RS-449 connector.

ET-10 Ethernet connector

Utilizes both standard and crossover pinouts on two RJ-45 connectors, providing connection to Ethernet systems utilizing UTP (unshielded twisted pair) cabling.

Cable and Termination

Use a shielded twisted pair cable between the **TTU02-MUX** and the DTE device. The receivers on the **TTU02-MUX** are 100 Ohm terminated (For X.21 and RS-530). If problems are encountered with the connection to the DTE interface, make sure that the DTE interface is terminated correctly.

2-5. DATA Interface Module Replacement

2-5-1. Caution

To avoid accidental electric shock, disconnect the **TTU02-MUX** power cord before opening the cover. Access inside the equipment is only permitted to authorized and qualified service personnel only.

2-5-2. Procedure

- a. Turn power OFF. Disconnect the power cord from the AC outlet.
- b. Loosen the captive thumb-screws on the left and right sides of the rear panel.
- c. Slide the outer housing forward to reveal the main PCB and data modules.
- d. Channel modules are secured with three Philips Head machine screws. The PC board designations CN9, CN8, CN7 and CN6 correspond to Data Port modules 1,2,3 and 4 respectively. Remove the screws and carefully lift the module off the internal 32 pin connector. Install a module with the reverse procedure, taking care to properly align the pins, seat the board, and apply the three screws. Visually check that all pins are seated and that none are bent.
- e. Slide the PCB assembly back into the outer housing and tighten the thumb-screws.

CHAPTER 2. INSTALLATION

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CHAPTER 3. FRONT PANEL OPERATION

3-1. GENERAL

This chapter describes the **TTU02-MUX** controls and indicators, and explains operation setup procedures. Installation procedures (in Chapter 2) must be completed and checked before attempting to operate the **TTU02-MUX**.

3-2. CONTROLS AND INDICATORS

All controls (push-button switches), LCD display and LED indicators are located on the **TTU02-MUX** front panel. The momentary on pushbutton switches are used to activate menu selections and select parameter settings.

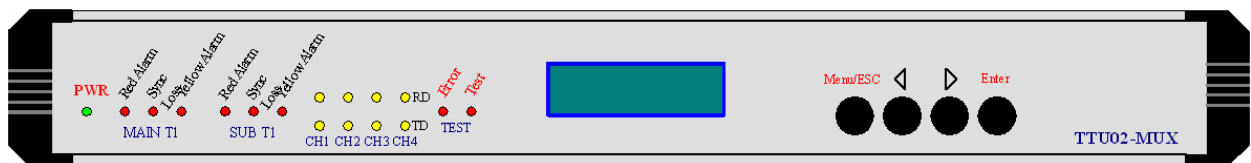


Figure 3-1 **TTU02-MUX** Front Panel

Use the '<' and '>' function keys to browse the menus and select parameters.

Use the '**MENU/ESC**' function key to return to a previous menu or to abandon setup.

Use the '**ENTER**' function key to set a parameter of a selection or to enter a sub-menu.

CHAPTER 3. FRONT PANEL OPERATION

3-3 LCD MENU OPERATION

3.3.1 Top Level Menus The following are the MAIN MENUs (top level). Press an arrow key to select another Main Menu or press ENTER to reach a sub menu.

```
<  S Y S T E M                >
  P A R A M E T E R
```

Set the Master and Fallback timing.

```
<  M A I N   L I N K          >
  P A R A M E T E R
```

Set the Frame type, idle code, Line code, RAI, and LBO for main T1(DS1) link.

```
<  S U B   L I N K           >
  P A R A M E T E R
```

Set the Frame type, idle code, Line code, RAI, and LBO for T1(DS1) sub-link.

```
<  T I M E   S L O T         >
  M A P P I N G
```

Assign the T1(DS1) timeslots to the Data Channels and/or T1(DS1) sub-link.

```
<  D A T A   P O R T         >
  P A R A M E T E R
```

Data Port Informational screen and settings for Clock Mode, Handshaking, and multiplier (n56K or n64K).

```
<  C O N T R O L   P O R T   >
  P A R A M E T E R
```

Setup for the terminal console port baud rate. Default is 9600, 8bit, no parity.

```
<  L O O P B A C K           >
  P A R A M E T E R
```

Enable main link, sub-link, or data channel Loopback.

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< B E R T T E S T >
P A R A M E T E R

Enable BERT, select channel, select pattern, do error insertion, and check results.

< D A T E & T I M E >
D I S P L A Y & S E T

Display and set the date and time for the internal real time clock of the **TTU02-MUX**.

< M I S C E L L A N E O U S >
S E T U P

Set the mode of the LCD backlight either Off, On, or Auto.

< A L A R M B U F F E R >
D I S P L A Y

Display and/or Clear the Alarm Buffer.

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3.3.2 System Parameter Detail The following screens show the setup screens under the System Parameter Main Screen.

SYSTEM PARAMETER.

```
<  S Y S T E M                >
  P A R A M E T E R
```

Press ENTER, MASTER TIMING sub-menu will be displayed. Master Timing sets the source for the timing in the **TTU02-MUX**.

```
<  M A S T E R   T I M I N G >
  M A I N   L I N K
```

Pressing ENTER again will place the cursors on the parameter selection line. The arrow keys are now used to browse the available parameters. Available parameters under Master Timing are:

MAIN LINK; Timing is recovered from the main T1(DS1) link.

SUB LINK; Timing is recovered from the T1(DS1) sub-link.

INT OSC; Timing is provided by the internal oscillator of the TTU02-MUX.

CH1 LINK; Timing is recovered from the Data Channel 1.

CH2 LINK; Timing is recovered from the Data Channel 2.

CH3 LINK; Timing is recovered from the Data Channel 3.

CH4 LINK; Timing is recovered from the Data Channel 4.

Press the ENTER key on the selected parameter. The cursors will return to the top line. Use the RIGHT arrow key to select the next sub-menu (BACKUP TIMING). The settings of backup timing are used as a "fallback" in case the main timing sync is lost. A typical setting for the backup timing would be the choice of internal oscillator.

```
<  B A C K U P   T I M I N G >
  I N T   O S C
```

Pressing ENTER will place the cursors on the parameter selection line. The arrow keys may now be used to browse the available parameters. Available parameters under Backup Timing are:

MAIN LINK; Timing is recovered from the main T1(DS1) link.

SUB LINK; Timing is recovered from the T1(DS1) sub-link.

INT OSC; Timing is provided by the internal oscillator of the TTU02-MUX.

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3.3.3 Main Link Parameter Detail The following screens show the setup screens under the Main Link Parameter Screen.

MAIN LINK PARAMETER

```
<  M A I N   L I N K           >
    P A R A M E T E R
```

Press ENTER and the MAIN LINK sub-menu will be displayed. Main Link sets the frame type, idle code, Line Code, RAI, and LBO state for the main T1(DS1) link of the **TTU02-MUX**.

```
<  M A I N   L I N K           >
    F R A M E : D 4 ( S F )
```

Use the arrow keys to browse the individual link parameters (frame, Idle code, etc.). Press ENTER on the parameter to select it with the cursors. Now use the arrow keys to browse the available settings for that parameter. The following is a breakdown of parameters and available settings:

FRAME: D4(SF), ESF, or UNFRAME; D4(SF) default.

IDLE:CODE; any hex code from 00 to FF; 7E default.

LINE CODE: B8ZS or AMI; B8ZS default.

RAI: (Remote Alarm Indicator) DISABLE or ENABLE; DISABLE default.

LBO: <133ft/0dB, 133-266ft, 266-399ft, 399-533ft, 533-655ft, -7.5dB, -15dB, -22.5dB; <133ft/0dB default

For transmission of unframed data, select UNFRAME for the main T1(DS1) link. In this case, all the Data Ports except CH1 are disabled (the data rate of CH1 is automatically set to 1.544 Mbps).

3.3.4 Sub Link Parameter Detail The following screens show the setup screens under the Sub Link Parameter Screen.

SUB LINK PARAMETER

```
<  S U B   L I N K           >
    P A R A M E T E R
```

Press ENTER and the SUB LINK sub-menu will be displayed. Sub Link sets the frame type, idle code, Line Code, LBO and RAI state for the T1(DS1) sub-link of the **TTU02-MUX**.

```
<  S U B   L I N K           >
    F R A M E : D 4 ( S F )
```

The parameters and settings for the T1(DS1) sub-link are the same as for the Main Link above.

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3.3.5 Timeslot Mapping Detail The following screen is an example of the screen under Timeslot Mapping.

TIME SLOT MAPPING

```
<  T I M E  S L O T          >
    M A P P I N G
```

Press ENTER.

```
F 1 1 2 2 3 3 4 4 D D N N N N N
N N N N N N N N N N
```

Press ENTER again.

```
F 1 1 2 2 3 3 4 4 D D N N N N N
N N N N N N N N N N      T S : 0 1
```

The T1(DS1) frame is shown with 24 timeslots, top row left to right are F bit, TS1-15, while the bottom row displays the settings for TS16-24. Press ENTER to move to the next TS, use the arrow keys to assign the timeslot as follows:

F = F-bit

N = not assigned

1 = Data Channel 1

2 = Data Channel 2

3 = Data Channel 3

4 = Data Channel 4

D = Data on T1(DS1) sub-link

V = Voice on T1(DS1) sub-link

3.3.6 Data Port Parameter Detail The following shows the setup screens under the Data Port Parameter Screen.

DATA PORT PARAMETER

```
<  D A T A  P O R T          >
    P A R A M E T E R
```

Press ENTER

```
< C H 1 : V . 3 5      D C E  >
    N 6 4      1 2 8 K b p s
```

CHAPTER 3. FRONT PANEL OPERATION

Use the arrow keys to display information for the other Data Port channels. The first line shows the port number followed by the interface type and clock mode. The second line shows that channel's multiplier value (56k or 64k) and the bandwidth used by the channel. In the above display, channel 1 is using an V.35 interface, clock mode set to DCE, 64k multiplier and 128kbps bandwidth.

While in the Data Port display, only the clock mode, handshaking and multiplier values are user settable. The interface type is auto-detected and the data bandwidth is calculated by multiplying the multiplier value times the number of timeslots assigned to the channel under the Timeslot Mapping screen. Pressing ENTER again will bring up the individual Data Port channel display.

```
< CHANNEL 1 >
MULTIPLIER: N64
```

Use the arrow keys to browse the available settings under the Data Port channel. They are:

Multiplier value; N64 or N56, default is N64

Clock mode; DCE, DTE1, DTE2, DTE3, default is DCE

CTS; ON or (follow) RTS, default is ON

Press the ENTER key to move the cursors to the Multiplier field. Select either N64 or N56 using the arrow keys, then press ENTER.

Press the right arrow key to select the Clock Mode screen.

```
< CHANNEL 1 >
CLK MODE: DCE
```

Press ENTER and use the arrow keys to browse the settings for CLK MODE. Press ENTER when the desired mode is shown. Use the arrow key to move on to the last parameter setting for CTS.

```
< CHANNEL 1 >
CTS: ON
```

Press ENTER to move the cursors to the CTS field. Select either ON or RTS using the arrow keys, then press ENTER. Press the MENU/ESC key to back out of the Channel 1 settings. Use the arrow key to select the other Channels and follow the same procedure to set multiplier, clock mode and handshaking settings.

CHAPTER 3. FRONT PANEL OPERATION

If the Data Port channel module is not installed a display similar to the following will be displayed.

```
< C H 3 : N C          D C E   >
      N 6 4           N C
```

3.3.7 Control Port Parameter Detail The following shows the setup screens under the Control Port Parameter Screen.

CONTROL PORT PARAMETER

```
<   C O N T R O L   P O R T   >
      P A R A M E T E R
```

Press ENTER

```
      C O N T R O L   P O R T
      9 6 0 0 b p s   8   N O N E
```

This screen shows the default settings for the Control Port.

Only the speed parameter is settable for the Control Port.

Speed; 300, 600, 1200, 2400, 4800, 9600, and 19200, default is 9600.

Data Length; fixed at 8 only.

Parity; fixed at NONE only.

Follow the normal screen procedures to set the speed parameter, then press MENU/ESC to return to the top menu.

3.3.8 Loopback Parameter Detail The following show the setup screens under the Loopback Parameter Screen.

LOOPBACK PARAMETER.

```
<   L O O P B A C K          >
      P A R A M E T E R
```

Press ENTER

```
<   M A I N   L I N K          >
      L O O P B A C K   O F F
```

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Use the arrow keys to browse the available options for Loopback setting. The details are as follows:

Main Link; Loopback Off, Local Analog, Local Digital, Local Payload, In-Band LLB, Out-Band LLB, Out-Band PLB, default is Loopback Off

Sub Link; Loopback Off, Local Analog, Local Digital, Local Payload, In-Band LLB, Out-Band LLB, Out-Band PLB, default is Loopback Off

Channel 1; Loopback Off, Local Analog or Local Digital Loop, default is Loopback Off

Channel 2; Loopback Off, Local Analog or Local Digital Loop, default is Loopback Off

Channel 3; Loopback Off, Local Analog or Local Digital Loop, default is Loopback Off

Channel 4; Loopback Off, Local Analog or Local Digital Loop, default is Loopback Off

All Channels; use this option to quickly turn Loopback Off for all channels.

3.3.9 BERT Test Detail The following show the setup screens

BERT TEST PARAMETER

```
<  B E R T   T E S T           >
    P A R A M E T E R
```

Press ENTER

```
<  B E R T   T E S T           >
    F U N C T I O N : O F F
```

Use the arrow keys to browse the available options for BERT test setting. The details are as follows:

Function; Off or On, default Off. Use to start BERT.

Channel; Ch1, Ch2, Ch3, Ch4, SL-ML (sub-link/main-link), or SL-SL, default is Ch1

Pattern; 511, 2047, 2e15-1, 2e20-1, QRSS, 2e23-1, All 1, All 0, Alt, 0011, 3in24, 1in16, 1in8, or 1in4, default is 511

Err Ins; NONE, Single, 10e-1, 10e-2, 10e-3, 10e-4, 10e-5, 10e-6, or 10e-7, default is NONE

Result; display the received error bit and error rate.

BERT TEST ERROR INSERT (SINGLE)

```
    B E R T   T E S T
< E R R   I N S : S I N G L E >
```

When selecting the Single Error insert the following screen will display.

```
B E R T   S I N G L E   E R R .
I N S E R T   [   E N T E R   ]
```

Press ENTER each time you want to insert an error.

CHAPTER 3. FRONT PANEL OPERATION

3.3.10 Date & Time Display & Set Detail The following shows the setup screens under the Date & Time Parameter Screen.

DATE & TIME DISPLAY & SET

```
<  D A T E    &    T I M E    >
  D I S P L A Y    &    S E T
```

Press ENTER to display current Date and Time.

```
D A T E    1 9 9 9 / 0 3 / 0 1
T I M E          0 0 : 0 0 : 0 8
```

Press ENTER again to define date and time. The cursor will be in the year field. Use the arrow keys to increment or decrement the year. Press ENTER to save and move on to the month field. Use the arrow keys again to change the month, press ENTER to save and move to the Day field. Continue this procedure for the time settings and then press MENU/ESC to start the clock from the set time. The clock used in the **TTU02-MUX** is fully Y2K compliant.

```
D A T E    1 9 9 9 / 0 4 / 2 4
T I M E          1 4 : 0 6 : 0 0
```

3.3.11 Miscellaneous Setup Detail The following shows the setup screens under the Miscellaneous Parameter Screen.

Miscellaneous Parameter Display

```
<  M I S C E L L A N E O U S  >
  S E T U P
```

Press ENTER.

```
<  M I S C E L L A N E O U S  >
  L C D   L I G H T : A U T O
```

Use the arrow keys to browse the available options for the LCD back lighting. They are:
AUTO; The backlight will automatically turn off in 5 minutes if no key is pressed. The backlight will automatically turn on again if any key is pressed. Default is AUTO.

ON; The backlight will remain permanently on.

OFF; The backlight will remain permanently off.

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Follow the normal menu procedures. From the Miscellaneous Setup menu use the arrow keys to browse to the RESET TO DEFAULT parameter function.

```
<  M I S C E L L A N E O U S  >
R E S E T   T O   D E F A U L T
```

Press ENTER.

```
R E S E T   T O   D E F A U L T
P R E S S   [ E N T E R ]
```

Press the ENTER key to completely reset all parameters to their original factory defaults

3.3.12 Alarm Buffer Display Detail Use this function to display and/or clear the Alarm Buffer.

```
<  A L A R M   B U F F E R   >
D I S P L A Y
```

Use the arrow keys to select between DISPLAY and CLEAR. To display press ENTER.

```
<  D I S P L A Y   A L A R M  >
B U F F E R
```

Press ENTER to display buffer. Refer to Table 5-2 in Chapter 5 TEST and DIAGNOSTICS, for the meaning of the displayed alarm.

If you use the arrow keys to browse to the CLEAR function, the following will be displayed.

```
<  C L E A R   A L A R M      >
B U F F E R   [ E N T E R ]
```

Press ENTER to clear the alarm buffer or press Menu/ESC to exit.

This completes the detailed discussion of the function setup of the **TTU02-MUX** via the front panel LCD display.

CHAPTER 3. FRONT PANEL OPERATION

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CHAPTER 4. CONTROL PORT OPERATION

4-1 General

The **TTU02-MUX** Control Port (labeled RS-232/Alarm on the rear panel) is a serial terminal port designed to facilitate setup of all parameters through the use of a standard text based terminal or any terminal emulation program running on a Personal Computer.

4-2 Terminal Connection

A notebook computer has become an invaluable tool of the Systems Engineer. Connection to the computer is very straight forward. The only other hardware required is a DB9-pin one-to-one, male to female cable. The **TTU02-MUX** acts as a DCE to the PC's DTE communications port. A convenient application, provided with the Microsoft Windows 9X operating systems, is "HyperTerminal™". Set the properties to match the **TTU02-MUX** control port defaults as follows: Baud=9600, Data bits=8, Parity=None, Stop bits=1, and handshaking =none. Make the appropriate connections, start the terminal application, apply power to the **TTU02-MUX**, then press ENTER on the PC keyboard. If you are using "HyperTerminal™" the display should look like the following.

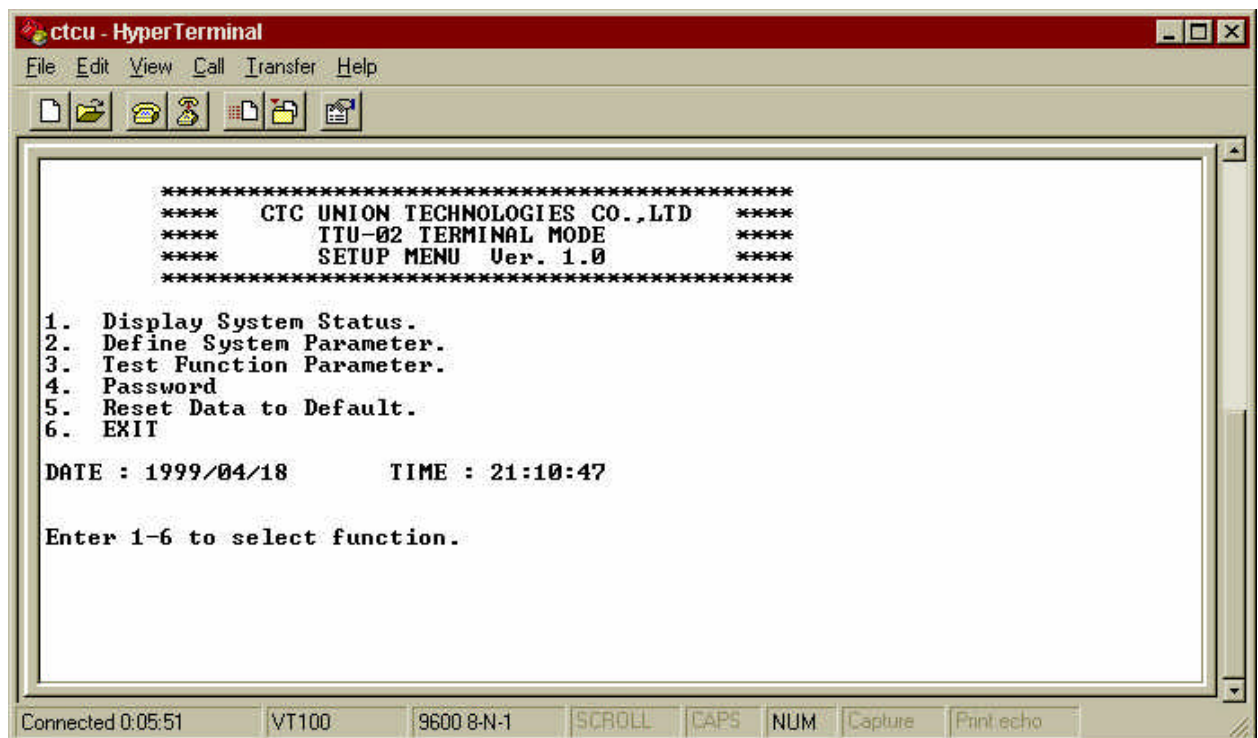


Figure 4-1. Example of terminal display

CHAPTER 4. CONTROL PORT OPERATION

4-3 Menu System Detail

The menu systems are displayed in the same order and with the same parameters as those in the LCD display. The following section will detail actual displays with descriptions of parameter settings via relevant key commands.

This is the first screen seen after connecting. Note that the first two items, Display and define deal with all the system settings. The Display item will browse settings for viewing only, while under Define, all parameters may be both viewed and changed.

```
*****
****      CTC UNION TECHNOLOGIES CO.,LTD      ****
****              TTU-02 TERMINAL MODE              ****
****              SETUP MENU  Ver. 1.00              ****
*****
```

1. Display System Status.
2. Define System Parameter.
3. Test Function Parameter.
4. Password
5. Reset Data to Default.
6. EXIT

DATE : 1999/03/01 TIME : 17:07:14

Enter 1-6 to select function.

Enter 1 to enter the Display System Status menu.

```
<< Display System Status >>
```

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Control Port
7. Alarm Buffer
8. BERT Test Result
9. TTU-02 Information

Enter 1-9 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

Enter 1 to display the Timing Parameters.

```
<<  Display Timing Parameter  >>

Master Timing : MAIN LINK
Back Timing   : INT OSC

Press "ESC" to previous menu.
```

The display shows that the Master Timing is derived from the main T1(DS1) link, while the fallback timing, if required, will be derived from the internal oscillator. To exit this menu to the previous one, Enter ESC.

```
<<  Display System Status  >>

1.  Timing
2.  Main Link
3.  Sub Link
4.  Time Slot
5.  Data Port
6.  Control Port
7.  Alarm Buffer
8.  BERT Test Result
9.  TTU-02 Information
```

Enter 1-9 or Press "ESC" to previous menu.

Enter 2 to display the settings for the main T1(DS1) link.

```
<<  Display Main Link Parameter  >>

Frame       : D4(SF)
Idle Code   : 7E
RAI         : DISABLE
Line Code   : B8ZS
LBO         : <133ft/0dB

Press "ESC" to previous menu.
```

The above display shows the settings for Frame type, Idle code, RAI setting, Line Code and LBO (Line Build Out) settings for the main T1(DS1) link. To return to the previous display, enter ESC.

CHAPTER 4. CONTROL PORT OPERATION

<< Display System Status >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Control Port
7. Alarm Buffer
8. BERT Test Result
9. TTU-02 Information

Enter 1-9 or Press "ESC" to previous menu.

To display the parameter settings for the T1(DS1) sub-link, enter 3.

<< Display Sub Link Parameter >>

Frame : D4(SF)
Idle Code : 7E
RAI : DISABLE
Line Code : B8ZS
LBO : <133ft/0dB

Press "ESC" to previous menu.

This display has shown the settings for Frame type, CRC setting, Idle code, RAI setting, Line Code and LBO settings for the T1(DS1) sub-link. To return to the previous display, enter ESC.

<< Display System Status >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Control Port
7. Alarm Buffer
8. BERT Test Result
9. TTU-02 Information

Enter 1-9 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

To display the Time Slot mapping details, enter 4.

```
<<  Display Time Slot Mapping  >>

SLOT :   01 02  03  04  05  06  07  08
TYPE :   C1 C1  C2  C2  C3  C3  C4  C4

SLOT :   09 10  11  12  13  14  15  16
TYPE :   SD SD  NC  NC  NC  NC  NC  NC

SLOT :   17 18  19  20  21  22  23  24
TYPE :   NC NC  NC  NC  NC  NC  NC  NC

NC: No define                C(1~4): Channel (1~4)
SD: Sub Link Data            SV: Sub Link Voice

Press "ESC" to previous menu.
```

The Time Slot mapping display shows the assignments for all of the 24 timeslots of the T1(DS1) frame. All timeslots 1~24 are shown with the assigned abbreviations shown directly beneath. To return to the previous display, enter ESC.

```
<<  Display System Status  >>

1.  Timing
2.  Main Link
3.  Sub Link
4.  Time Slot
5.  Data Port
6.  Control Port
7.  Alarm Buffer
8.  BERT Test Result
9.  TTU-02 Information
```

Enter 1-9 or Press "ESC" to previous menu.

To display the Data Port parameter settings for each channel module, enter 5.

```
<<  Display Data Port Parameter  >>

PORT  TYPE  CLOCK  MULTI  CTS  V.54  SPEED
1      V.35  DCE    N64    ON   OFF   128Kbps
2      V.35  DCE    N64    ON   OFF   128Kbps
3      NC    DCE    N64    ON   OFF   128Kbps
4      NC    DCE    N64    ON   OFF   128Kbps
```

Press "ESC" to previous menu.

Enter ESC to return to the Display System Status menu.

CHAPTER 4. CONTROL PORT OPERATION

<< Display System Status >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Control Port
7. Alarm Buffer
8. BERT Test Result
9. TTU-02 Information

Enter 1-9 or Press "ESC" to previous menu.

Enter 6 to display the Control Port settings.

<< Display Control Port Parameter >>

SPEED : 9600bps
DATA : 8
PARITY: NONE

Press "ESC" to previous menu.

The display shows the current settings. To return to the main display press ESC.

<< Display System Status >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Control Port
7. Alarm Buffer
8. BERT Test Result
9. TTU-02 Information

Enter 1-9 or Press "ESC" to previous menu.

Enter 9 to display the TTU02 Information screen.

<< Display TTU-02 Information >>

EPLD Version : 01
FPGA Version : 01

DATE : 1999/03/01 TIME : 17:07:46

Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

The information displayed shows the hardware version numbers of the EPLD and FPGA chips in the TTU-02. To exit this display, press ESC. Then press ESC again to go to the very top menu display.

```
*****
****   CTC UNION TECHNOLOGIES CO.,LTD   ****
****   TTU-02 TERMINAL MODE             ****
****   SETUP MENU  Ver. 1.00            ****
*****
```

1. Display System Status.
2. Define System Parameter.
3. Test Function Parameter.
4. Password
5. Reset Data to Default.
6. EXIT

DATE : 1999/03/01 TIME : 17:07:51

Enter 1-6 to select function.

Now we will look at defining the system parameters. To do this enter 2.

```
<< Define System Parameter >>
```

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

The first selection of system parameters is the Timing parameter, so let's enter 1.

```
<< Define Timing Parameter >>
```

1. Master Timing
2. Back Timing

Enter 1-2 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

To define the master timing, enter 1.

```
<< Define Master Timing Parameter >>

Master Timing : MAIN LINK

1. Main Link
2. Sub Link
3. INT OSC
4. Channel 1
5. Channel 2
6. Channel 3
7. Channel 4

Enter 1-7 or Press "ESC" to previous menu.
```

The display shows that the master timing is currently derived from the Main link. To change, select one of the appropriate choices from 1~7 or to exit without changing press ESC.

```
<< Define Timing Parameter >>

1. Master Timing
2. Back Timing

Enter 1-2 or Press "ESC" to previous menu.
```

To define the fallback timing, enter 2.

```
<< Define Back Timing Parameter >>

Back Timing : INT OSC

1. Main Link
2. Sub Link
3. INT OSC

Enter 1-3 or Press "ESC" to previous menu.
```

The display shows that the fallback timing is currently derived from the internal oscillator. To change, select one of the appropriate choices from 1~3 or to exit without changing press ESC.

CHAPTER 4. CONTROL PORT OPERATION

<< Define Timing Parameter >>

1. Master Timing
2. Back Timing

Enter 1-2 or Press "ESC" to previous menu.

Enter ESC to leave the Timing Parameter menu and return to Defining System Parameters.

<< Define System Parameter >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

To define system parameters for the main T1(DS1) link, enter 2.

<< Define Main Link Parameter >>

1. FRAME
2. IDLE CODE
3. RAI
4. LINE CODE
5. LBO

Enter 1-5 or Press "ESC" to previous menu.

To define the Frame type for the main T1(DS1) link, press 1.

<< Define Main Link Frame Parameter >>

Frame : D4(SF)

1. D4(SF)
2. ESF
3. UNFRAME

Enter 1-3 or Press "ESC" to previous menu.

The current frame type setting is D4(SF).

CHAPTER 4. CONTROL PORT OPERATION

To change the frame type, enter 1~3. To exit and leave the setting unchanged, press ESC.

```
<< Define Main Link Parameter >>
```

1. FRAME
2. IDLE CODE
3. RAI
4. LINE CODE
5. LBO

Enter 1-5 or Press "ESC" to previous menu.

To define the Idle code for the main T1(DS1) link, enter 2.

```
<< Define Main Link Idle Code >>
```

Idle Code : 7E

Enter Code (00~FF) :

Enter the new Idle code with the hex value 00~FF, or to exit, press ESC.

```
<< Define Main Link Parameter >>
```

1. FRAME
2. IDLE CODE
3. RAI
4. LINE CODE
5. LBO

Enter 1-5 or Press "ESC" to previous menu.

To enable or disable the Remote Alarm Indicator, press 3.

```
<< Define Main Link RAI Parameter >>
```

RAI : DISABLE

1. Disable
2. Enable

Enter 1-2 or Press "ESC" to previous menu.

Press 1 to disable, 2 to enable RAI, or press ESC to exit without changing.

CHAPTER 4. CONTROL PORT OPERATION

<< Define Main Link Parameter >>

1. FRAME
2. IDLE CODE
3. RAI
4. LINE CODE
5. LBO

Enter 1-5 or Press "ESC" to previous menu.

To change the Line Code press 4.

<< Define Line Code Parameter >>

Line Code :B8ZS

1. B8ZS
2. AMI

Enter 1-2 or Press "ESC" to previous menu.

Press 1 to define a Line Code of B8ZS, press 2 to define a Line Code of AMI or press ESC.

<< Define Main Link Parameter >>

1. FRAME
2. IDLE CODE
3. RAI
4. LINE CODE
5. LBO

Enter 1-5 or Press "ESC" to previous menu.

Press 5 to define the LBO (Line Build Out).

<< Define Main Link LBO >>

LBO :<133ft/0dB

1. <133ft/0dB
2. 133~266ft
3. 266~399ft
4. 399~533ft
5. 533~655ft
6. -7.5dB
7. -15dB
8. -22.5dB

Enter 1-8 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

Enter 1-8 to set the LBO for the main link or press "ESC" to leave unchanged. Press ESC twice to return to the top of the System Define menu.

<< Define System Parameter >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

To define system parameters for the T1(DS1) sub-link, enter 3.

<< Define Sub Link Parameter >>

1. FRAME
2. IDLE CODE
3. RAI
4. LINE CODE
5. LBO

Enter 1-5 or Press "ESC" to previous menu.

As you can see, the parameters for sub-link are identical to the Main Link parameters. Refer to the Main Link parameters as a guide for setting the sub-link. Press ESC.

<< Define System Parameter >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

To define the Timeslot mapping assignments, press 4.

```
<< Define Time Slot Mapping >>

TIME SLOT 01
TYPE : Channel 1

1.  NC
2.  Channel 1
3.  Channel 2
4.  Channel 3
5.  Channel 4
6.  Sub Link Data
7.  Sub Link Voice

Enter 1-7 or Press "ENTER" to next Time Slot or
"ESC" to previous menu.
```

The slot number and map type are shown. Select 1~7 as appropriate, press ENTER to move on to the next timeslot or ESC to exit the mapping function. If we press the ENTER key now, the second timeslot will be displayed.

```
<< Define Time Slot Mapping >>

TIME SLOT 02
TYPE : Channel 1

1.  NC
2.  Channel 1
3.  Channel 2
4.  Channel 3
5.  Channel 4
6.  Sub Link Data
7.  Sub Link Voice

Enter 1-7 or Press "ENTER" to next Time Slot or
"ESC" to previous menu.
```

Continue to set the timeslot mapping assignments, go on to the next timeslot or ESC. This will take us back to the System Parameter menu.

CHAPTER 4. CONTROL PORT OPERATION

<< Define System Parameter >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

Press 5 to define the Data port parameters.

<< Define Data Port Parameter >>

1. Channel 1
2. Channel 2
3. Channel 3
4. Channel 4

Enter 1-4 or Press "ESC" to previous menu.

Press the appropriate number 1~4 corresponding to the Data Port channel to be defined.

<< Define Channel 1 Parameter >>

PORT	TYPE	CLOCK	MULTI	CTS	V.54	SPEED
1	V.35	DCE	N64	ON	OFF	128Kbps

1. Clock Mode
2. Multiplier
3. CTS
4. V.54 Loopback

Enter 1-4 or Press "ESC" to previous menu.

Press 1 to define the clock mode for the selected channel.

<< Define Channel 1 Clock Mode >>

1. DCE
2. DTE1
3. DTE2
4. DTE3

Enter 1-4 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

Choose the desired clock mode or ESC to the channel selection menu.

```
<< Define Channel 1 Parameter >>

PORT  TYPE  CLOCK  MULTI  CTS  V.54  SPEED
1      V.35  DCE    N64    ON   OFF   128Kbps

1.  Clock Mode
2.  Multiplier
3.  CTS
4.  V.54 Loopback
```

Enter 1-4 or Press "ESC" to previous menu.

Press item 2 to set the channel multiplier.

```
<< Define Channel 1 Multiplier Parameter >>

1.  N64
2.  N56
```

Enter 1-2 or Press "ESC" to previous menu.

Press 1 to enter n64 multiplier, 2 to enter n56 multiplier or ESC to leave unchanged.

```
<< Define Channel 1 Parameter >>

PORT  TYPE  CLOCK  MULTI  CTS  V.54  SPEED
1      V.35  DCE    N64    ON   OFF   128Kbps

1.  Clock Mode
2.  Multiplier
3.  CTS
4.  V.54 Loopback
```

Enter 1-4 or Press "ESC" to previous menu.

Now we will set the CTS parameter. Press 3.

```
<< Define Channel 1 CTS Parameter >>

1.  ON
2.  RTS
```

Enter 1-2 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

Enter the appropriate setting for CTS or press ESC to exit without changing.

<< Define Channel 1 Parameter >>

PORT	TYPE	CLOCK	MULTI	CTS	V.54	SPEED
1	V.35	DCE	N64	ON	OFF	128Kbps

1. Clock Mode
2. Multiplier
3. CTS
4. V.54 Loopback

Enter 1-4 or Press "ESC" to previous menu.

Press 4 to define the parameter for V.54 loopback codes.

<< Define Channel 1 V.54 Loopback Parameter >>

V.54 Loopback :OFF

1. OFF
2. ON

Enter 1-2 or Press "ESC" to previous menu.

Enter 2 to enable loopback, 1 to ignore standard V.54 loopback codes. Press ESC to leave unchanged. Press ESC again to exit to the Define Data Port Parameter menu.

<< Define Data Port Parameter >>

1. Channel 1
2. Channel 2
3. Channel 3
4. Channel 4

Enter 1-4 or Press "ESC" to previous menu.

Choose another channel for setting or press ESC to exit to the Define System Parameter.

<< Define System Parameter >>

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

The following is an example of setting the system date and time. Press 6.

```
<< Define Date & Time >>

1.  DATE
2.  TIME

DATE : 1999/03/01  TIME : 17:11:25

Enter 1-2 or Press "ESC" to previous menu.
```

To define the Date, press 1. Enter the 4 digit year, followed by the month (single digit months must have a leading zero) and complete with the day (single digit days must have a leading zero).

```
<< Define Date >>

YEAR (1900 ~ 2099) : 1999
MONTH ( 01 ~ 12 )  : 05
DAY   ( 01 ~ 31 )  : 03
```

Following entry of the Date, the screen will revert to the Define Date & Time screen.

```
<< Define Date & Time >>

1.  DATE
2.  TIME

DATE : 1999/05/03  TIME : 01:16:59

Enter 1-2 or Press "ESC" to previous menu.
```

To define the time, press 2.

```
<< Define Time >>

HOUR (00 ~ 23) : 16
MINUTE (00 ~ 59) : 13
SECOND (00 ~ 59) : 00
```

Enter the Hour, Minutes, and Seconds. (Single digit entries must have a leading zero.)

Press ESC to start the date clock from the entered settings.

CHAPTER 4. CONTROL PORT OPERATION

To return to the upper level menu, press ESC.

```
<< Define System Parameter >>
```

1. Timing
2. Main Link
3. Sub Link
4. Time Slot
5. Data Port
6. Date & Time

Enter 1-6 or Press "ESC" to previous menu.

Press ESC again to reach the top level menu.

```
*****
****   CTC UNION TECHNOLOGIES CO.,LTD   ****
****           TTU-02 TERMINAL MODE           ****
****           SETUP MENU  Ver. 1.00           ****
*****
```

1. Display System Status.
2. Define System Parameter.
3. Test Function Parameter.
4. Password
5. Reset Data to Default.
6. EXIT

DATE : 1999/05/03 TIME : 16:13:13

Enter 1-6 to select function.

Now we will move on to setting the Test Function parameters, press 3.

```
<< Define Test Mode Function >>
```

1. LoopBack Test
2. Bert Test

Enter 1-2 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

First we will look at the item Loopback Test, press 1.

```
<< Define LoopBack Test Port >>

Main Link LoopBack: LOOPBACK OFF   Sub Link  LoopBack: LOOPBACK OFF
Channel 1 LoopBack: LOOPBACK OFF   Channel 2 LoopBack: LOOPBACK OFF
Channel 3 LoopBack: LOOPBACK OFF   Channel 4 LoopBack: LOOPBACK OFF

1. Main Link
2. Sub Link
3. Channel 1
4. Channel 2
5. Channel 3
6. Channel 4
7. All Channel LoopBack OFF
```

Enter 1-7 or Press "ESC" to previous menu.

The first three lines of the display show the current loopback status of the Main and Sub T1(DS1) links as well as the four Data Channels. In the next example we will set loopback for the Main Link. Press 1.

```
<< Main Link LoopBack >>

Main Link LoopBack : LOOPBACK OFF

1. OFF
2. LOCAL ANALOG
3. LOCAL DIGITAL
4. LOCAL PAYLOAD
5. IN-BAND
6. OUT-BAND LLB (ESF only)
7. OUT-BAND PLB (ESF only)

Enter 1-7 or Press "ESC" to previous menu.
```

The choices presented are to turn OFF loopback or turn ON Local Analog, Local Digital, Local Payload, In-Band, or Out-Band loopback. On the following page is an example of a display where Local Analog loopback test has been selected for the main link.

CHAPTER 4. CONTROL PORT OPERATION

The display of all loopback status can be observed. Note that the Main Link is now set for Local Analog Loopback.

```
<< Define LoopBack Test Port >>
```

```
Main Link LoopBack: LOCAL ANALOG   Sub Link  LoopBack: LOOPBACK OFF
Channel 1 LoopBack: LOOPBACK OFF   Channel 2 LoopBack: LOOPBACK OFF
Channel 3 LoopBack: LOOPBACK OFF   Channel 4 LoopBack: LOOPBACK OFF
```

1. Main Link
2. Sub Link
3. Channel 1
4. Channel 2
5. Channel 3
6. Channel 4
7. All Channel LoopBack OFF

Enter 1-7 or Press "ESC" to previous menu.

Now we will select the Main Link again (Press 1) and turn OFF loopback.

```
<< Main Link LoopBack >>
```

```
Main Link LoopBack : LOCAL ANALOG
```

1. OFF
2. LOCAL ANALOG
3. LOCAL DIGITAL
4. LOCAL PAYLOAD
5. IN-BAND
6. OUT-BAND LLB (ESF only)
7. OUT-BAND PLB (ESF only)

Enter 1-7 or Press "ESC" to previous menu.

Press 1 to turn Off loopback.

CHAPTER 4. CONTROL PORT OPERATION

Press ESC and the status will again be displayed.

<< Define LoopBack Test Port >>

Main Link LoopBack: LOOPBACK OFF	Sub Link LoopBack: LOOPBACK OFF
Channel 1 LoopBack: LOOPBACK OFF	Channel 2 LoopBack: LOOPBACK OFF
Channel 3 LoopBack: LOOPBACK OFF	Channel 4 LoopBack: LOOPBACK OFF

1. Main Link
2. Sub Link
3. Channel 1
4. Channel 2
5. Channel 3
6. Channel 4
7. All Channel LoopBack OFF

Enter 1-7 or Press "ESC" to previous menu.

Press ESC to back out to the Define Test Mode menu.

<< Define Test Mode Function >>

1. LoopBack Test
2. Bert Test

Enter 1-2 or Press "ESC" to previous menu.

Select item 2 to define the BERT test. The display shows that BERT function is OFF but is set to run on Channel 1 with the 511 pattern.

<< Bert Test Parameter >>

Function : OFF	Channel : CH1
Pattern : 511	Error Insert : NONE

1. Function
2. Channel
3. Pattern
4. Error Insert
5. Result

Enter 1-5 or Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

To start BERT function, select item 1.

```
<< Bert Test Function >>

Function : OFF

1.  OFF
2.  ON

Enter 1-2 or Press "ESC" to previous menu.
```

Enter 2 to Start the BERT function. Enter 1 to Stop BERT function. The next screen will show the function status.

```
<< Bert Test Function >>

Function : ON

1.  OFF
2.  ON

Enter 1-2 or Press "ESC" to previous menu.
```

Press ESC.

Here are the status results.

```
<< Bert Test Parameter >>

Function : ON      Channel  : CH1
Pattern : 511      Error Insert : NONE

1.  Function
2.  Channel
3.  Pattern
4.  Error Insert
5.  Result

Enter 1-5 or Press "ESC" to previous menu.
```


CHAPTER 4. CONTROL PORT OPERATION

Now we will select a different channel for BERT testing. Press 2.

```
<< Bert Test Channel >>

Channel : CH1

1. Channel 1
2. Channel 2
3. Channel 3
4. Channel 4
5. Sub Link to Main Link
6. Sub Link to Sub Link

Enter 1-6 or Press "ESC" to previous menu.
```

Enter 2, to select channel 2 for testing.

```
<< Bert Test Channel >>

Channel : CH2

1. Channel 1
2. Channel 2
3. Channel 3
4. Channel 4
5. Sub Link to Main Link
6. Sub Link to Sub Link

Enter 1-6 or Press "ESC" to previous menu.
```

The results screen will show again.

```
<< Bert Test Parameter >>

Function : ON      Channel : CH2
Pattern : 511     Error Insert : NONE

1. Function
2. Channel
3. Pattern
4. Error Insert
5. Result

Enter 1-5 or Press "ESC" to previous menu.
```

CHAPTER 4. CONTROL PORT OPERATION

Now select a different pattern for testing. Enter 3.

```
<< Bert Test Pattern >>

Pattern : 511

1. 511
2. 2047
3. 2T1(DS1)5-1
4. 2e20-1
5. QRSS
6. 2e23-1
7. ALL 1
8. ALL 0
9. ALT
A. 0011
B. 3in24
C. 1in16
D. 1in8
E. 1in4

Enter 1-E or Press "ESC" to previous menu.
```

In this example, we will enter 9, to select the ALT 0101 pattern.

```
<< Bert Test Pattern >>

Pattern : ALT

1. 511
2. 2047
3. 2T1(DS1)5-1
4. 2e20-1
5. QRSS
6. 2e23-1
7. ALL 1
8. ALL 0
9. ALT
A. 0011
B. 3in24
C. 1in16
D. 1in8
E. 1in4

Enter 1-E or Press "ESC" to previous menu.
```

CHAPTER 4. CONTROL PORT OPERATION

Press ESC. Note in the results screen below, the function is ON, channel is CH2 and pattern is ALT.

```
<< Bert Test Parameter >>

Function : ON      Channel  : CH2
Pattern  : ALT     Error Insert : NONE

1. Function
2. Channel
3. Pattern
4. Error Insert
5. Result

Enter 1-5 or Press "ESC" to previous menu.
```

An important function of BERT is the ability to insert errors at a pre-defined error rate or to insert single bit errors on command. Press 4.

```
<< Bert Test Error Insert >>

Error Insert : NONE

1. NONE
2. SINGLE
3. 10e-1
4. 10e-2
5. 10e-3
6. 10e-4
7. 10e-5
8. 10e-6
9. 10e-7

Enter 1-9 or Press "ESC" to previous menu.
```

Press 2, to insert single errors on command.

```
<< Bert Test Error Insert >>

Press "ENTER" to insert single error or "ESC" to
previous menu
```

With each press of the ENTER key, an error will be inserted.

CHAPTER 4. CONTROL PORT OPERATION

Press ENTER inserts an error.

```
<< Bert Test Error Insert >>
```

Press "ENTER" to insert single error or "ESC" to previous menu

Press ESC.

```
<< Bert Test Error Insert >>
```

Error Insert : SINGLE

1. NONE
2. SINGLE
3. 10e-1
4. 10e-2
5. 10e-3
6. 10e-4
7. 10e-5
8. 10e-6
9. 10e-7

Enter 1-9 or Press "ESC" to previous menu.

Press ESC again to the Parameter results screen.

```
<< Bert Test Parameter >>
```

Function : ON Channel : CH2
Pattern : ALT Error Insert : SINGLE

1. Function
2. Channel
3. Pattern
4. Error Insert
5. Result

Enter 1-5 or Press "ESC" to previous menu.

To view the results of BERT testing, press 5.

```
<< Display BERT Test Results >>
```

Rx Bit: 0
Rx Error Bit: 0
Rx Error Rate: 0.0e-00

Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

After viewing the BERT results, press ESC.

```
<< Bert Test Parameter >>

Function : ON      Channel  : CH2
Pattern  : ALT     Error Insert : SINGLE

1. Function
2. Channel
3. Pattern
4. Error Insert
5. Result

Enter 1-5 or Press "ESC" to previous menu.
```

To turn off the BERT function, call up the function menu. Press 1.

```
<< Bert Test Function >>

Function : ON

1. OFF
2. ON

Enter 1-2 or Press "ESC" to previous menu.
```

Press 1, to turn off BERT.

```
<< Bert Test Function >>

Function : OFF

1. OFF
2. ON

Enter 1-2 or Press "ESC" to previous menu.
```

Press ESC.

CHAPTER 4. CONTROL PORT OPERATION

<< Bert Test Parameter >>

Function : OFF Channel : CH2
Pattern : ALT Error Insert : SINGLE

1. Function
2. Channel
3. Pattern
4. Error Insert
5. Result

Enter 1-5 or Press "ESC" to previous menu.

Press ESC again.

<< Define Test Mode Function >>

1. LoopBack Test
2. Bert Test

Enter 1-2 or Press "ESC" to previous menu.

Press ESC one last time to reach to top level menu.

```
*****
****   CTC UNION TECHNOLOGIES CO.,LTD   ****
****           TTU-02 TERMINAL MODE           ****
****           SETUP MENU  Ver. 1.00           ****
*****
```

1. Display System Status.
2. Define System Parameter.
3. Test Function Parameter.
4. Password
5. Reset Data to Default.
6. EXIT

DATE : 1999/05/03 TIME : 16:15:49

Enter 1-6 to select function.

CHAPTER 4. CONTROL PORT OPERATION

The following is an example of Password setting for the *TTU02-MUX*.

Press 4.

```
<< Password >>
```

1. Set Password
2. Clear Password

Enter 1-2 or Press "ESC" to previous menu.

Enter 1 to set the password.

```
<< Entry Password >>
```

Enter Password (4 Number) :

Enter 1234.

```
*** Password entry successful. ***
```

Press "ESC" to previous menu.

Press ESC.

```
<< Password >>
```

1. Set Password
2. Clear Password

Enter 1-2 or Press "ESC" to previous menu.

To clear the password, press 2.

```
<< Clear Password >>
```

Enter Original Password :

Enter the original password, 1234.

```
*** Password is DISABLED ***
```

Press "ESC" to previous menu.

CHAPTER 4. CONTROL PORT OPERATION

Press ESC.

<< Password >>

1. Set Password
2. Clear Password

Enter 1-2 or Press "ESC" to previous menu.

Press ESC back to main menu.

```
*****
****   CTC UNION TECHNOLOGIES CO.,LTD   ****
****           TTU-02 TERMINAL MODE           ****
****           SETUP MENU  Ver. 1.00           ****
*****
```

1. Display System Status.
2. Define System Parameter.
3. Test Function Parameter.
4. Password
5. Reset Data to Default.
6. EXIT

DATE : 1999/05/03 TIME : 16:16:12

Enter 1-6 to select function.

To reset all parameters to the original factory default settings, press 5. The following will immediately be displayed.

```
***   RESET TO DEFAULT   ***
```

Press "ENTER" to confirm or "ESC" to previous menu.

Pressing "ENTER" will reset all parameters to the factory defaults and clear the clock. Press "ESC" to exit without resetting. Following a reset the following message is displayed.

```
***   Already Reset Data to Default.   ***
```

Press ESC.

CHAPTER 4. CONTROL PORT OPERATION

```
*****
****   CTC UNION TECHNOLOGIES CO.,LTD   ****
****   TTU-02 TERMINAL MODE             ****
****   SETUP MENU  Ver. 1.00            ****
*****
```

1. Display System Status.
2. Define System Parameter.
3. Test Function Parameter.
4. Password
5. Reset Data to Default.
6. EXIT

DATE : 1999/03/01 TIME : 00:00:05

Enter 1-6 to select function.

To exit the terminal mode. press 6. The terminal connection will be dropped and the following will be displayed.

TTU-02 TERMINAL MODE IS DISCONNECTED

This completes the detailed examples of terminal mode operation for the *TTU02-MUX*.

CHAPTER 4. CONTROL PORT OPERATION

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CHAPTER 5. TEST and DIAGNOSTICS

5-1. GENERAL

The **TTU02-MUX** diagnostics functions include:

- Status indications and messages.
- User activated loopback.
- Integrated Bit Error Rate Test (BERT).

The loopback tests are activated via the user data port, front panel LCD interface or from the console terminal menu. The **TTU02-MUX** also offers bit error rate testing on both the synchronous data channel or the T1(DS1) sub link, using a locally generated pseudo-random sequence. To provide compatibility with other BERT equipment, you may define the pseudo-random pattern.

5-2. STATUS INDICATORS AND MESSAGES

Indicators:

The status of the **TTU02-MUX** is indicated by viewing the Red Alarm, Sync Loss, Yellow Alarm, Error and Test LED indicators. User data channel activity is indicated by the corresponding RD and TD LED indicators.

Table 5-1 LED indicators

Indicator	Color	Function
PWR	Green	ON when power is on.
Red Alarm	Red	ON when received signal is lost.(main T1(DS1) & sub T1(DS1))
Sync Loss	Red	ON when received frame sync is lost.(main T1(DS1) & sub T1(DS1))
Yellow Alarm	Red	ON when main T1(DS1) or sub T1(DS1) has a remote alarm (RAI).
RD	Yellow	ON when SPACE is being received.(CH1,CH2,CH3,CH4) Off when MARK is being received. Flashing when data is received.
TD	Yellow	ON when SPACE is being transmitted (CH1,CH2,CH3,CH4) Flashing when data is transmitted.
Error	Red	ON when BERT function is activated and detects bit errors.
Test	Red	ON when the TTU02-MUX is in any loopback mode or BERT function is on. Flashing when local unit is in loopback initiated from the remote unit

CHAPTER 5. TEST and DIAGNOSTICS

Display:

The **TTU02-MUX** maintains an alarm buffer. The buffer can store one alarm event of each type along with the time of occurrence. A minimum of 256 alarms may be displayed on the front panel or the terminal.

Table 5-2 presents the alarm messages generated by the **TTU02-MUX**.

Table 5-2 Alarm Message

Message	Description	Corrective Actions	Alarm type
POWER	Power ON/OFF time.		ON/OFF
BRG1 FAILURE	The data port CH1-CH4 baud rate generator failure. Only tested at power on.	Check the clock mode of the responding user data channel.	ON
BRG2 FAILURE		Replace the TTU02-MUX .	
BRG3 FAILURE			
BRG4 FAILURE			
FIFO1 SLIP	The data port CH1-CH4 FIFO buffer suffered an overflow or underflow, usually caused by inconsistencies in clock rates.	Check the clock mode of the responding user data channel.	ON
FIFO2 SLIP		Replace the TTU02-MUX .	
FIFO3 SLIP			
FIFO4 SLIP			
FALLBACK CLK	The TTU02-MUX has switched to the backup clock source.	Check the master clock source: ML-fails when the main link suffers a loss of signal. CH1, CH2, CH3, CH4-fails when data channel equipment is disconnected or inoperative. SL-fails when the sub link suffers a loss of signal.	ON/OFF
DATABASE CS ERR	The TTU02-MUX technical failure. The data base currently stored in the non-volatile memory is corrupted.	Press ENTER to load the default configuration, resetting all the parameters. Perform the power up self test and replace the TTU02-MUX if a failure is detected.	ON/OFF
SELF TEST ERR	A problem has been detected during power on self-test.	Replace the TTU02-MUX .	ON

CHAPTER 5. TEST and DIAGNOSTICS

ML SIG. LOSS	Loss of main link receive signal.	Check cable connections to the main link connector. Check other equipment providing the link to the TTU02-MUX .	ON/OFF
ML SYNC LOSS	Loss of main link frame sync.	Check cable connections to the main link connector. Check other equipment providing the same frame link to the TTU02-MUX . Replace the TTU02-MUX .	ON/OFF
ML BPV ERROR	Bipolar violations in the main link receive signal. Updated once per second.	Check that line attenuation does not exceed that specified for T1(DS1) line. Check other equipment providing the same line code to the TTU02-MUX .	ON
ML CRC-6 ERROR	CRC-6 errors detected in main link receive signal. Updated once per second.	Check other equipment providing the same frame link to the TTU02-MUX .	ON
ML FRAME SLIP	Main link frame slips are detected. Updated once per second.	Incorrect selection of master clock source. Problem with the equipment connected to the remote end of the link, unstable clock source.	ON
ML AIS	Main link receiving an all ones signal.	Problem with the equipment connected to the remote end of the link.	ON/OFF
SL SIG. LOSS	Loss of sub link receive signal.	Check cable connections to the sub link connector. Check other equipment providing the link to the TTU02-MUX .	ON/OFF
SL SYNC LOSS	Loss of sub link frame sync.	Check cable connections to the sub link connector. Check other equipment providing the same frame link to the TTU02-MUX . Replace the TTU02-MUX .	ON/OFF

CHAPTER 5. TEST and DIAGNOSTICS

SL BPV ERROR	Bipolar violations in the sub link receive signal. Updated once per second.	Check that line attenuation does not exceed that specified for T1(DS1) line. Check other equipment providing the same line code to the TTU02-MUX .	ON
SL CRC-6 ERROR	CRC-6 errors detected in sub link receive signal. Updated once per second.	Check other equipment providing the same frame link to the TTU02-MUX .	ON
SL FRAME SLIP	Sub link frame slips are detected. Updated once per second.	Incorrect selection of master clock source. Problem with the equipment connected to the remote end of the link, unstable clock source.	ON
SL AIS	Main link receiving all ones signal.	Problem with the equipment connected to the remote end of the link.	ON/OFF

5-3. USER activated loopback.

The **TTU02-MUX** supports the following types of test loopbacks.

Main link local analog loopback.

Main link local digital loopback.

Main link local payload loopback.

Main link In-Band LLB.

Main link Out-Band LLB.

Main link Out-Band PLB.

Sub link local analog loopback.

Sub link local digital loopback.

Sub link local payload loopback.

Sub link In-Band LLB

Sub link Out-Band LLB

Sub link Out-Band PLB

Channel 1-4 local loopback.

Channel 1-4 remote loopback.

The user activated loopback functions are accessed from the LOOPBACK PARAMETER menu. The available test functions are described in the following pages.

Main link local analog loopback

The Main link local analog loopback is performed by connecting the main link transmit signal to the input of the receive path on the analog side (CSU), as shown in Figure 5-1. This returns the transmit signal of each port on the receive path of the same port. Each channel (including sub link) must receive its own transmission. This loopback fully tests the local **TTU02-MUX** operation and the connections to the local DTE. During this loopback, the **TTU02-MUX** main link sends an unframed "all ones" signal to the remote equipment. Before connecting this loopback, disconnect the LAN cable from any rear panel Ethernet Bridge interface module.

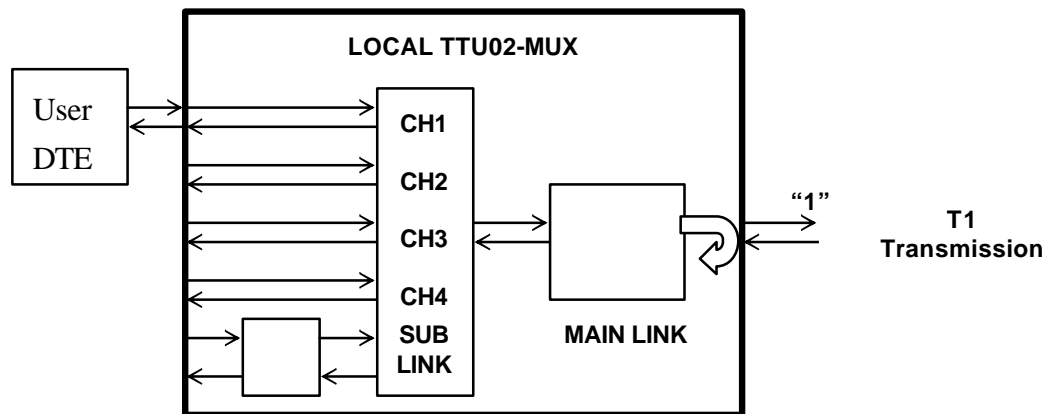


Figure 5-1. Main link local analog loopback

Main link local digital loopback

Main link local digital loopback is performed by connecting the main link receive signal to the output of the transmit path, on the analog side (CSU). This loopback test checks the performance of the local **TTU02-MUX**, the remote **TTU02-MUX** and the connections between them, as shown in Figure 5-2.

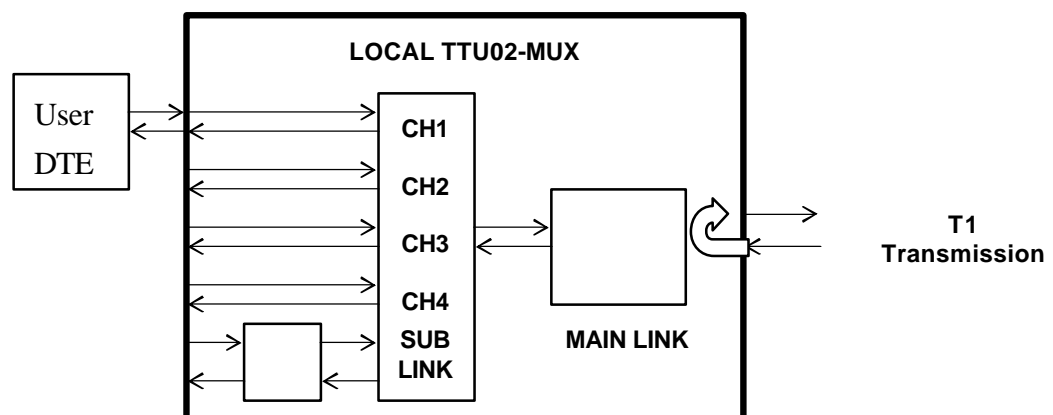


Figure 5-2. Main link local digital loopback

CHAPTER 5. TEST and DIAGNOSTICS

Main link local payload loopback

Main link local payload loopback is performed by connecting the main link receive signal to the output of the transmit path in digital mode (DSU side). This loopback test checks the performance of the local **TTU02-MUX**, the remote **TTU02-MUX** and the connections between them, as shown in Figure 5-3.

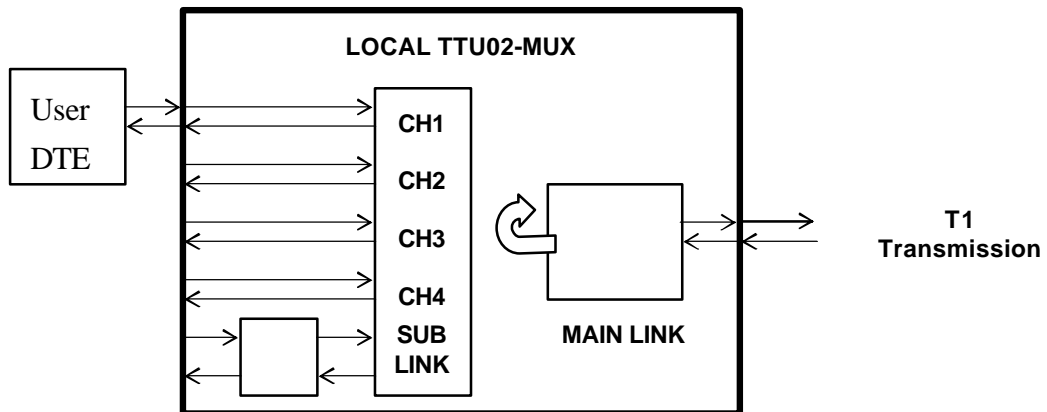


Figure 5-3. Main link local payload loopback

Sub link local analog loopback

Sub link local analog loopback is performed by connecting the sub link receive signal to the output of the transmit path, as shown in Figure 5-4. This loopback test checks the connection to the equipment connected to the local sub link. The test signal is provided by the equipment connected to the local sub link.

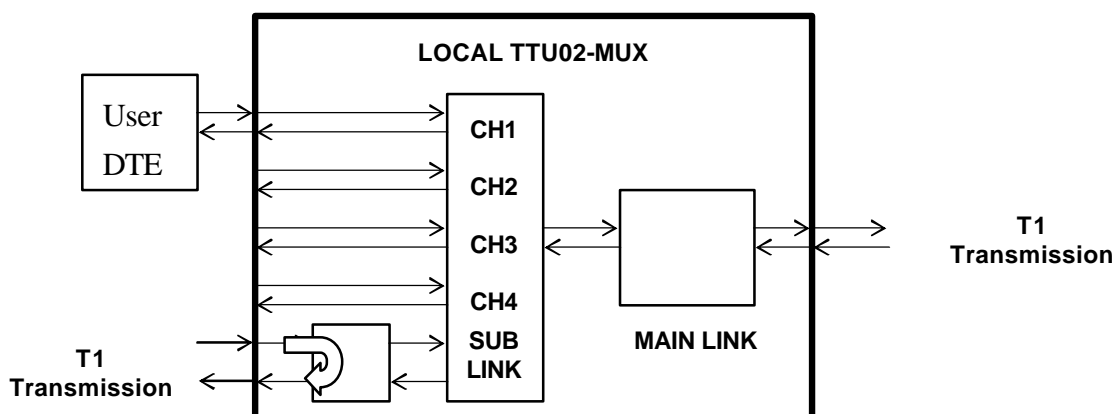


Figure 5-4. Sub link local analog loopback

Sub link local digital loopback

Sub link local digital loopback is performed by connecting the sub link transmit signal to the input of the receive path, as shown in Figure 5-5. The test signal is provided by the equipment connected to the remote sub link. During this loopback, the **TTU02-MUX** sub link sends an unframed "all ones" signal to the equipment connected to the local sub link.

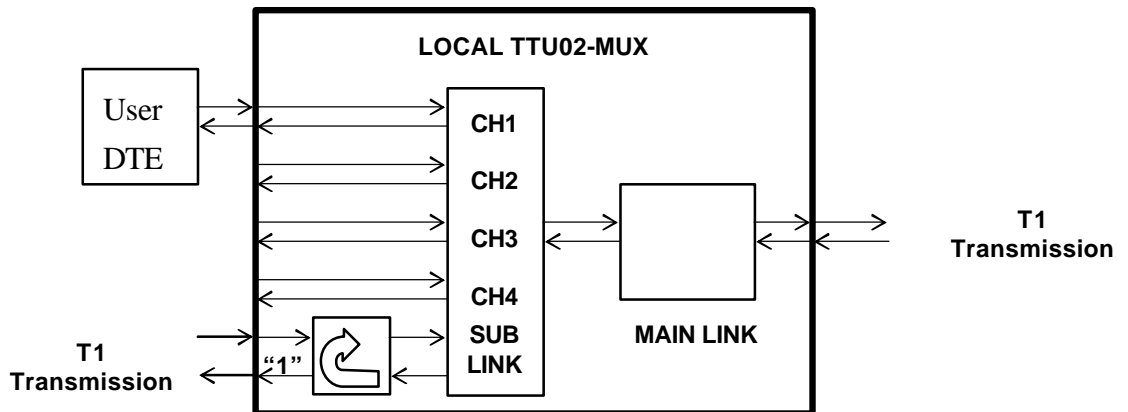


Figure 5-5. Sub link local digital loopback

Sub link local payload loopback

Sub link local payload loopback is performed by connecting the sub link receive signal to the output of the transmit path (digital mode) behind the CSU, as shown in Figure 5-6. This loopback test checks the connection to the equipment connected to the local sub link. The test signal is provided by the equipment connected to the local sub link.

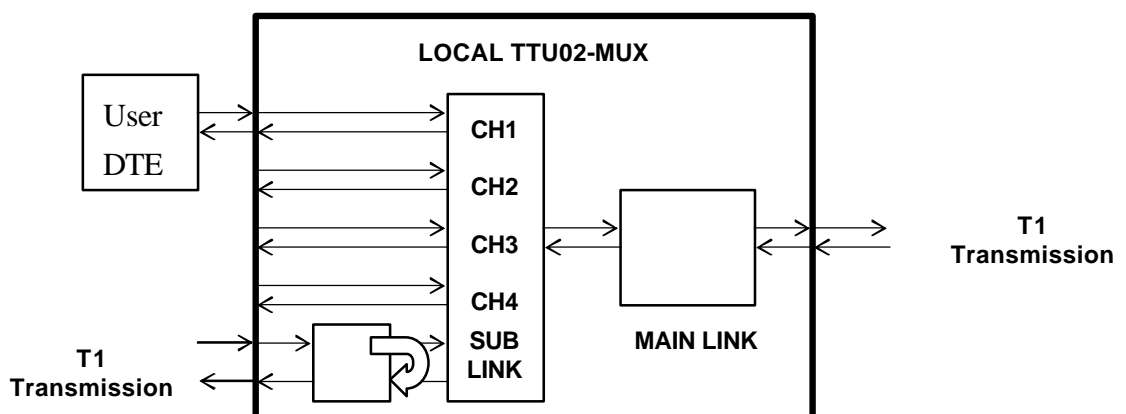


Figure 5-6. Sub link local payload loopback

CHAPTER 5. TEST and DIAGNOSTICS

Channel 1-4 local analog loopback.

Channel local analog loopback is performed by connecting the data channel transmit data (TD) to the input of the receive path (RD), as shown in Figure 5-7. The test signal is provided by the local DTE.

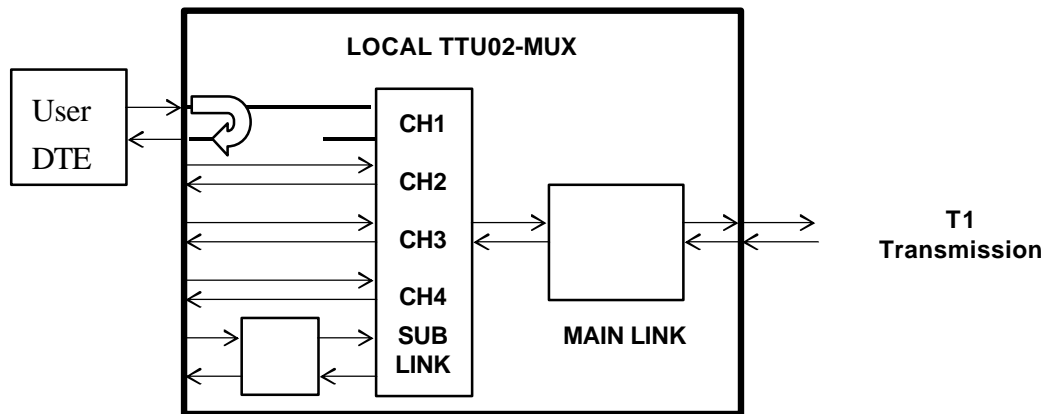


Figure 5-7. Channel local analog loopback

Channel 1-4 local digital loopback.

Channel local digital loopback is performed by connecting the local data channel receive data (RD) to the data channel transmit input (TD), as shown in Figure 5-8. The test signal is provided by the remote user DTE.

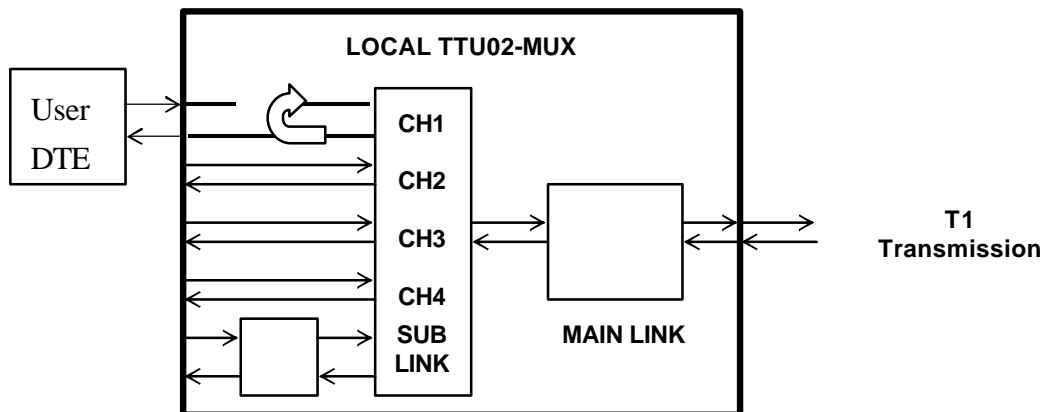


Figure 5-8. Channel local digital loopback

CHAPTER 5. TEST and DIAGNOSTICS

Integrated Bit Error Rate Test (BERT).

BERT testing can be performed on only one channel at a time. During the test, the local DTE is disconnected and the DSR line is off. An internal pattern generator connects a user selected test sequence to the transmit input of the local data channel interface. To calibrate the system, the user can inject errors at a selectable rate. The receive output is connected to a pattern tester. The tester compares the received and transmitted patterns and detects errors.

For a **local test**, use the main link local analog loopback (or hardwire main link RX connector to TX), to return the data back to the local DTE, as shown in Figure 5-9.

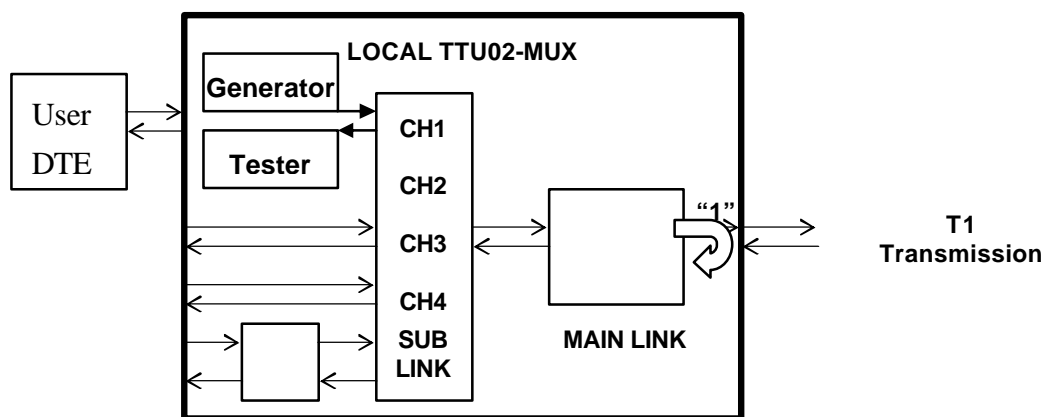


Figure 5-9. BERT for local test
(BERT on Channel 1, Main Link analog loopback.)

For a **system test**, use the remote side main link remote analog loopback, or data channel remote loopback, to return the data back to the local user DTE, as shown in Figure 5-10.

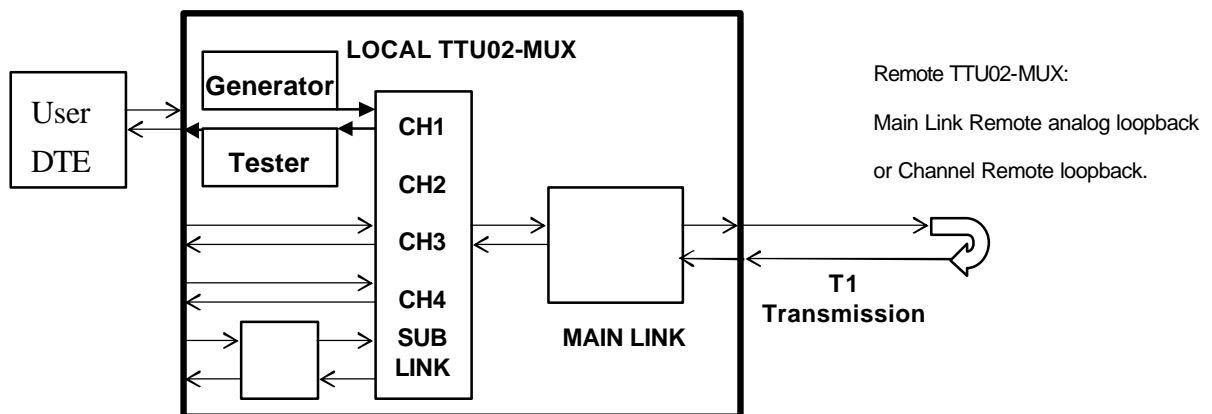


Figure 5-10. BERT used for system test

CHAPTER 5. TEST and DIAGNOSTICS

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CHAPTER 6. TROUBLESHOOTING INSTRUCTIONS

In case a problem occurs, check the displayed alarm messages and refer to the Alarm Messages section in Table 5-2.

NO.	Trouble Symptoms	Probable cause	Corrective measure
1	PWR indicator off	No AC power.	Check that both ends of the AC power cable are properly connected.
		Blown fuse.	Replace with fuse of proper rating.
		Defective TTU02-MUX .	Replace the TTU02-MUX .
2	PWR indicator flashes	Hardware failure.	Replace the TTU02-MUX .
3	MAIN T1(DS1) Red Alarm indicator on	No signal received from the remote device.	Check cable connections to the main link connector. Check other equipment providing the link to the TTU02-MUX . Activate the local analog loopback on the main link. Check if the TTU02-MUX MAIN T1(DS1) Sync Loss indicator is off, then the problem is external.
		Defective TTU02-MUX .	Replace the TTU02-MUX .
4	MAIN T1(DS1) Sync Loss indicator on	Wrong frame format.	Check cable connections to the main link connector. Check other equipment providing the same frame link to the TTU02-MUX or reset local TTU02-MUX frame format.
		Defective TTU02-MUX .	Replace the TTU02-MUX .
5	MAIN T1(DS1) Yellow Alarm indicator on (RAI)	D4 bit 2 mode (RCR2.2=0)	When bit 2 of 256 consecutive channels is set to zero for at least 254 occurrences. Check other equipment providing the same line code to the TTU02-MUX .
		D4 12 th F-bit mode (RCR2.2=1)	The 12 th framing bit is set to one for two consecutive occurrences. Check other equipment providing the same frame link to the TTU02-MUX .
		ESF mode	When 16 consecutive patterns of 00FF appear in the FDL. Problem at the equipment connector to the remote end of the link.

CHAPTER 6. TROUBLESHOOTING INSTRUCTIONS

NO.	Trouble Symptoms	Probable cause	Corrective measure
6	SUB T1(DS1) Red Alarm indicator on	No signal receive from the remote device.	Check cable connections to the sub link connector. Check other equipment providing the link to the TTU02-MUX . Activate the local analog loopback on the sub link. Check if the TTU02-MUX SUB T1(DS1) Sync Loss indicator is off, then the problem is external.
		Defective TTU02-MUX .	Replace the TTU02-MUX .
7	SUB T1(DS1) Sync Loss indicator on	Wrong frame format.	Check cable connections to the sub link connector. Check other equipment providing the same frame link to the TTU02-MUX or reset local TTU02-MUX frame format.
		Defective TTU02-MUX .	Replace the TTU02-MUX .
8	SUB T1(DS1) Yellow Alarm indicator on (RAI)	D4 bit 2 mode (RCR2.2=0)	When bit 2 of 256 consecutive channels is set to zero for at least 254 occurrences. Check other equipment providing the same line code to the TTU02-MUX .
		D4 12 th F-bit mode (RCR2.2=1)	The 12 th framing bit is set to one for two consecutive occurrences. Check other equipment providing the same frame link to the TTU02-MUX .
		ESF mode	When 16 consecutive patterns of 00FF appear in the FDL. Problem at the equipment connector to the remote end of the link.

APPENDIX A. DIP SWITCH SETTING

A-1 DSW1 SETTING

DSW1	STATE	FUNCTION	CONDITION
-1	OFF	Reserved	
	ON	Reserved	
-2	OFF	Reserved	
	ON	Reserved	
-3	OFF	Reserved	
	ON	Reserved	
-4	OFF	Reserved	
	ON	Reserved	
-5	OFF	Reserved	
	ON	Reserved	

A-2 JUMPER CHASS1 FRAME GROUND SETTING

CHASS1	STATE	FUNCTION	CONDITION
ALL	DIS	Frame ground not connected to signal	Factory setting
	CON	Frame ground connected to signal ground	

CHASS1 is located on the main PC board.

APPENDIX A. DIP SWITCH SETTING

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Appendix B. Connectors & I/F Modules

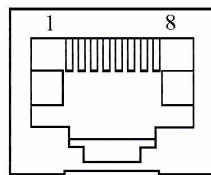
B-1. T1(DS1) LINE CONNECTORS

B-1.1 D-15 connector

The T1(DS1) link D-15 connector conforms to AT&T Pub 62411. The physical interface is a 15-pin female D-type connector.

Pin	Designation	Direction	Function
1	TTIP	From TTU02-MUX	Transmit data
2	FG	↔	Frame ground
3	RTIP	To TTU02-MUX	Receive data
4	FG	↔	Frame ground
5	--	--	--
6	--	--	--
7	--	--	--
8	--	--	--
9	TRING	From TTU02-MUX	Transmit data
10	--	--	--
11	RRING	To TTU02-MUX	Receive data
12	--	--	--
13	--	--	--
14	--	--	--
15	--	--	--

Table B-1 T1(DS1) DB-15 connector pin allocation



B-1.2 RJ-45connector

Conn.	Pin	Designation	Direction	Function
RJ-45	5	TTIP	From TTU02-MUX	Transmit data(+)
	4	TRING	From TTU02-MUX	Transmit data(-)
	2	RTIP	To TTU02-MUX	Receive data(+)
	1	RRING	To TTU02-MUX	Receive data(-)
	7,8	FG	↔	Shield Ground

Table B-2 T1(DS1) RJ-45 connector pin allocation

Appendix B. Connectors & I/F Modules

B-2. X.21 USER DATA CHANNEL CONNECTOR

When the **TTU02-MUX** is ordered with an X.21 interface, the physical interface is a 15-pin female D-type connector wired in accordance with Table B-3.

SIGNAL FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	1	Shield	↔	Chassis ground. May be isolated from Signal Ground.
Signal Ground	8	G	↔	Common signal ground.
Transmitted Data	2 9	T(A) T(B)	To TTU02-MUX	Serial digital data from DTE.
Received Data	4 11	R(A) R(B)	Fm TTU02-MUX	Serial digital data at the output of the TTU02-MUX receiver.
Request to Sent	3 10	C(A) C(B)	To TTU02-MUX	An ON signal to the TTU02-MUX when data transmission is desired.
Data Carrier Detect	5 12	I(A) I(B)	Fm TTU02-MUX	Constantly ON, except when a loss of the received carrier signal is detected.
Signal Timing	6 13	S(A) S(B)	Fm TTU02-MUX	A transmit data rate clock for use by an external data source.
External Transmit clock	7 14	B(A) B(B)	To TTU02-MUX	A serial data rate clock input from the data source.
--	15	--	--	--

Table B-3 X.21 user data channel connector pin allocation

Appendix B. Connectors & I/F Modules

B-3. V.35 USER DATA CHANNEL CONNECTOR

When the **TTU02-MUX** is ordered with a V.35 interface, the physical interface is a 34-pin female M-type connector wired in accordance with Table B-4 below.

SIGNAL FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	A	Frame	↔	Chassis ground. May be isolated from signal ground.
Signal Ground	B	Signal Ground	↔	Common signal ground.
TD	P S	TD(A) TD(B)	To <i>TTU02-MUX</i>	Serial digital data from DTE.
RD	R T	RD(A) RD(B)	Fm <i>TTU02-MUX</i>	Serial digital data at the output of the <i>TTU02-MUX</i> receiver.
RTS	C	RTS	To <i>TTU02-MUX</i>	An ON signal to the <i>TTU02-MUX</i> when data transmission is desired.
CTS	D	CTS	Fm <i>TTU02-MUX</i>	Constantly ON.
DSR	E	DSR	Fm <i>TTU02-MUX</i>	Constantly ON, except during test loops.
DTR	H	DTR	To <i>TTU02-MUX</i>	Not used.
DCD	F	DCD	Fm <i>TTU02-MUX</i>	Constantly ON, except when a loss of the received carrier signal is detected.
ETC	U W	ETC(A) ETC(B)	To <i>TTU02-MUX</i>	A transmitted data rate clock input from the data source.
Transmit Clock	Y AA	TC(A) TC(B)	Fm <i>TTU02-MUX</i>	A transmitted data rate clock for use by an external data source.
Receive Clock	V X	RC(A) RC(B)	Fm <i>TTU02-MUX</i>	A received data rate clock for use by an external data source.
External Receive clock	Z BB	ERC(A) ERC(B)	To <i>TTU02-MUX</i>	A received serial data rate clock input from the DTE.
Remote Loopback	HH	RL	To <i>TTU02-MUX</i>	When on, commands <i>TTU02-MUX</i> into remote loopback, can disable by DIPSW.
Local Loopback	JJ	LL	To <i>TTU02-MUX</i>	When on, commands <i>TTU02-MUX</i> into local loopback, can be disabled by DIPSW.
Test Indicator	KK	TM	Fm <i>TTU02-MUX</i>	ON during any test mode

Table B-4 V.35 user data channel connector pin allocation

Appendix B. Connectors & I/F Modules

B-4. RS-530 USER DATA CHANNEL CONNECTOR

When the **TTU02-MUX** is ordered with an RS-530 interface, the physical interface is a 25-pin female D-type connector wired in accordance with Table B-5.

FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	1	Frame	↔	Chassis ground. May be isolated from signal ground.
Signal Ground	7	AB	↔	Common signal ground.
Transmitted Data	2 14	BA(A) BA(B)	To <i>TTU02-MUX</i>	Serial digital data from DTE.
Received Data	3 16	BB(A) BB(B)	Fm <i>TTU02-MUX</i>	Serial digital data at the output of the <i>TTU02-MUX</i> receiver.
Request to Sent	4 19	CA(A) CA(B)	To <i>TTU02-MUX</i>	A ON signal to the <i>TTU02-MUX</i> when data transmission is desired.
Clear to Sent	5 13	CB(A) CB(B)	Fm <i>TTU02-MUX</i>	Constantly ON.
Data Set Ready	6 22	CC(A) CC(B)	Fm <i>TTU02-MUX</i>	Constantly ON, Except during test loops.
Data Terminal Ready	20 23	CD(A) CD(B)	To <i>TTU02-MUX</i>	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8 10	CF(A) CF(B)	Fm <i>TTU02-MUX</i>	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	24 11	DA(A) DA(B)	To <i>TTU02-MUX</i>	A transmitted data rate clock input from the data source.
Transmit Clock	15 12	DB(A) DB(B)	Fm <i>TTU02-MUX</i>	A transmitted data rate clock for use by an external data source.
Receive Clock	17 9	DD(A) DD(B)	Fm <i>TTU02-MUX</i>	A received data rate clock for use by an external data source.
Remote Loopback	21	RL	To <i>TTU02-MUX</i>	When on, commands <i>TTU02-MUX</i> into remote loopback, can disable by DIPSW.
Local Loopback	18	LL	To <i>TTU02-MUX</i>	When on, commands <i>TTU02-MUX</i> into local loopback, can disable by DIPSW.
Test Indicator	25	TM	Fm <i>TTU02-MUX</i>	ON during any test mode

Table B-5 RS-530 user data channel connector pin allocation

Appendix B. Connectors & I/F Modules

B-5. RS-232 USER DATA CHANNEL CONNECTOR

When the **TTU02-MUX** is ordered with an RS-232 interface, the physical interface is a 25-pin female D-type connector wired in accordance with Table B-6.

FUNCTION	PIN	CIRCUIT	DIRECTION	DESCRIPTION
Protective Ground	1	AA	↔	Chassis ground. May be isolated from signal ground.
SG	7	AB	↔	Common signal ground.
Transmitted Data	2	BA	To <i>TTU02-MUX</i>	Serial digital data from DTE.
Received Data	3	BB	Fm <i>TTU02-MUX</i>	Serial digital data at the output of the <i>TTU02-MUX</i> receiver.
Request to Sent	4	CA	To <i>TTU02-MUX</i>	A ON signal to the <i>TTU02-MUX</i> when data transmission is desired.
Clear to Sent	5	CB	Fm <i>TTU02-MUX</i>	Constantly ON.
Data Set Ready	6	CC	Fm <i>TTU02-MUX</i>	Constantly ON, Except during test loops.
Data Terminal Ready	20	CD	To <i>TTU02-MUX</i>	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8	CF	Fm <i>TTU02-MUX</i>	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	24	DA	To <i>TTU02-MUX</i>	A transmitted data rate clock input from the data source.
Transmit Clock	15	DB	Fm <i>TTU02-MUX</i>	A transmitted data rate clock for use by an external data source.
Receive Clock	17	DD	Fm <i>TTU02-MUX</i>	A received data rate clock for use by an external data source.
Remote Loopback	21	RL	To <i>TTU02-MUX</i>	When on, commands <i>TTU02-MUX</i> into remote loopback, can disable by DIPSW.
Local Loopback	18	LL	To <i>TTU02-MUX</i>	When on, commands <i>TTU02-MUX</i> into local loopback, can disable by DIPSW.
Test Indicator	25	TM	Fm <i>TTU02-MUX</i>	ON during any test mode

Table B-6 RS-232 user data channel connector pin allocation

Note: The RS-232 module is designed for synchronous transmissions. Asynchronous signals may be used also. Please multiply the baud rate by 3.5 and apply the required number of 64Kbps timeslots. A 19,200 baud will require one timeslot. For 33.6k (33,600x3.5=117,600) two 64K timeslots (117,600/64,000=1.8375 ~ 2) would be required.

Appendix B. Connectors & I/F Modules

B-6. RS-530 to RS-449 ADAPTER CABLE

When the **TTU02-MUX** is ordered with an RS-449 interface, the physical interface is a 37-pin male D-type connector wired in accordance with Table B-7.

SIGNAL FUNCTION	RS-530 PIN	RS-449 PIN	RS-449 CIRCUIT	DESCRIPTION
Protective Ground	1	1	Frame	Chassis ground. May be isolated from signal ground.
Signal Ground	7	19,20,37	SG,RC,SC	Common signal ground.
Transmitted Data	2 14	4 22	SD(A) SD(B)	Serial digital data from DTE.
Received Data	3 16	6 24	RD(A) RD(B)	Serial digital data at the output of the <i>TTU02-MUX</i> receiver.
Request to Sent	4 19	7 25	RS(A) RS(B)	A ON signal to the <i>TTU02-MUX</i> when data transmission is desired.
Clear to Sent	5 13	9 27	CS(A) CS(B)	Constantly ON.
Data Set Ready	6 22	11 29	DM(A) DM(B)	Constantly ON, Except during test loops.
Data Terminal Ready	20 23	12 30	TR(A) TR(B)	DTR not used, used for a received serial data rate clock input from the DTE.
Data Carrier Detect	8 10	13 31	RR(A) RR(B)	Constantly ON, except when a loss of the received carrier signal is detected.
External Transmit clock	24 11	17 35	TT(A) TT(B)	A transmitted data rate clock input from the data source.
Transmit Clock	15 12	5 23	ST(A) ST(B)	A transmitted data rate clock for use by an external data source.
Receive Clock	17 9	8 26	RT(A) RT(B)	A received data rate clock for use by an external data source.
Remote Loopback	21	14	RL	When on, commands <i>TTU02-MUX</i> into remote loopback, can disable by DIPSW.
Local Loopback	18	10	LL	When on, commands <i>TTU02-MUX</i> into local loopback, can disable by DIPSW.
Test Indicator	25	18	TM	ON during any test mode

Table B-7 RS-530 to RS-449 pin allocation

Appendix B. Connectors & I/F Modules

B-7. G.703/64K Codirectional USER DATA CHANNEL CONNECTOR

When the **TTU02-MUX** is ordered with a G.703/64K Codirectional interface, the physical interface is a 15-pin female D-type connector wired in accordance with Table B-8.

SIGNAL FUNCTION	PIN	DIRECTION	DESCRIPTION
Shield	4 10	↔	Chassis ground. May be isolated from Signal Ground.
Transmitted Data	3 11	To TTU02-MUX	Serial codirectional data from DTE.
Received Data	1 9	Fm TTU02-MUX	Serial codirectional data at the output of the TTU02-MUX receiver.

Table B-8 G.703/64K Codirectional data channel connector pin allocation

Appendix B. Connectors & I/F Modules

B-8. NRZ/BNC USER DATA CHANNEL CONNECTOR

When the **TTU02-MUX** is ordered with a NRZ/BNC interface, the physical interface is four (4) female BNC type connectors wired in accordance with Table B-9.

SIGNAL FUNCTION	CIRCUIT	DIRECTION	DESCRIPTION
Transmitted Data	TD	To TTU02-MUX	Serial NRZ data from DTE.
Received Data	RD	Fm TTU02-MUX	Serial NRZ data at the output of the TTU02-MUX receiver.
Transmit Timing	TC	To TTU02-MUX	Transmit timing signal.
Received Timing	RC	Fm TTU02-MUX	Received timing signal.

Table B-9 NRZ/BNC user data channel connector pin allocation

Appendix B. Connectors & I/F Modules

B-9. RS-232/ALARM PORT CONNECTOR

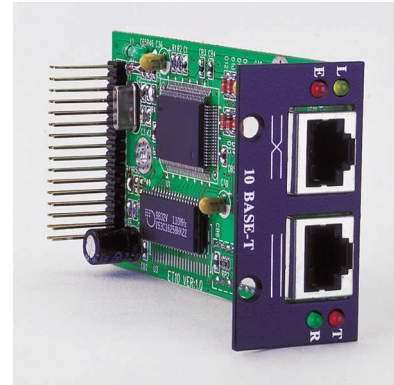
The **TTU02-MUX** RS-232/ALARM port has a standard RS-232 DCE interface terminal in a 9-pin female D-type connector, wired in accordance with Table B-10.

Pin	RS-232 Function	Direction	Connected to Terminal		Alarm Relay function
			DB9	DB25	
1	Data Carrier Detect (DCD)	Output	1	8	
2	Receive Data (RD)	Output	2	3	
3	Transmit Data (TD)	Input	3	2	
4					Normally closed (NC)
5	Signal Ground		5	7	
6					Common contact (COM)
7	Request To Sent (RTS)	Input	7	4	
8	Clear To Sent (CTS)	Output	8	5	
9					Normally open (NO)

Table B-10 RS-232/ALARM port connector pin allocation

B-10. ET10 Ethernet Bridge Module

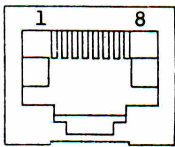
When the **TTU02-MUX** is ordered with an **ET10 Interface**, the unit is not only a multiplexer unit for T1, but also becomes a high performance WAN bridge for 10Base-T Ethernet extension. Utilizing both standard and crossover pin outs on two RJ-45 connectors, the ET10 provides connection to Ethernet networks utilizing UTP (unshielded twisted pair) cabling.



Ethernet interface (10Base-T Bridge) Specifications

Compliance	IEEE 802.3
Interface type	10Base-T for use on UTP and STP media
Data rate	10Mbps (20Mbps/10Base-T in full duplex topology)
Interface Connectors	2-8 pin, RJ-45 (10Base-T, straight and crossover)
LAN table	10,000 MAC address with 5 second automatic aging
Filtering and Forwarding	15,000 frames/sec
Buffer	256 frames
Delay	1 frame

The physical interface for the **ET10** is a RJ-45 connector, with the pin assignment as follows:



Normal	Crossover
1. Tx +	1. Rx +
2. Tx -	2. Rx -
3. Rx +	3. Tx +
6. Rx -	6. Tx -

DIP Switch Settings

DIP/NO.	STATE	FUNCTION
1	ON	ID, factory default
2	ON	
3	ON	
4	OFF	
5	ON	
6	ON	MAC Enable Filter ¹
	OFF	MAC Disable Filter ²
7	ON	Disable Compression
	OFF	Enable Compression
8	ON	Half Duplex Ethernet
	OFF	Full Duplex Ethernet

LED Indicators

Designation	Indication
R	Receive data
T	Transmit data
E	Error
L	Link

Table B-11 ET10 Dip setting

1. This is the normal mode for bridging, with MAC filter enabled.
2. With the filter disabled, the **ET10** essentially becomes only a repeater.

Appendix B. Connectors & I/F Modules

B-11. ET10/100 Ethernet Bridge Module

Utilizes standard pin out on one RJ-45 connector, providing connection to Ethernet (10Base-T) or Fast Ethernet (100Base-TX) networks utilizing UTP (unshielded twisted pair) cabling.

MDI	MDI-X
1. Tx +	1. Rx +
2. Tx -	2. Rx -
3. Rx +	3. Tx +
6. Rx -	6. Tx -

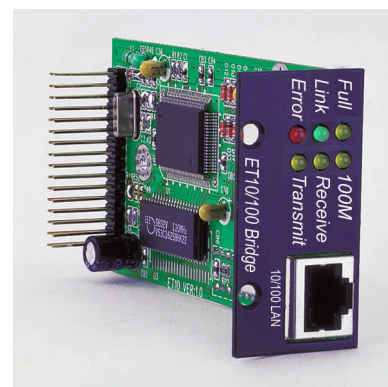
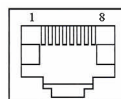


Table B-12-a ET10/100 pin allocation

DIP Switch Settings

DIP	State		Function
1	ON*		Enable MAC filtering
	OFF		Disable Filtering (repeater)
2	ON		Enable 802.3x flow control
	OFF*		Disable 802.3x flow control
3	ON		NO Auto-negotiation
	OFF*		Auto-negotiation
4	ON		Half Duplex ¹
	OFF*		Full Duplex ¹
5	ON		10BASE-T LAN speed ¹
	OFF*		100BASE-TX LAN speed ¹
6	ON		Enable Auto MDIX
	OFF*		MDI (1:1 to HUB)
7 8	OFF	OFF	Memory configuration #1
	ON	OFF	Memory configuration #2
	OFF	ON	Memory configuration #3
	ON	ON	Reserved

Table B-12-b DIP switch settings

* factory default settings

¹ no effect when sw3 is off (auto-negotiation is on)

LED Indicators

Designation	Indication
Full (yellow)	ON=Full Duplex
Link (green)	ON=LAN Link
Error (red)	ON=LAN Error
100M (yellow)	ON=Fast Ethernet
Receive (yellow)	ON=LAN Rx data
Transmit(yellow)	ON=LAN Tx data

Table B-12-c LED indicators

Memory configuration detail

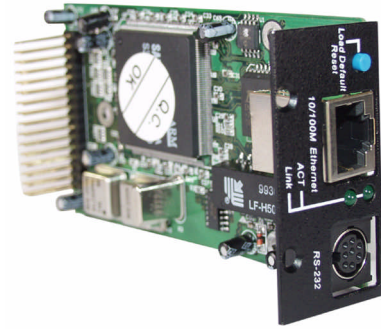
#1 LAN to WAN 308 packets, WAN to LAN 32 packets

#2 LAN to WAN 170 packets, WAN to LAN 170 packets

#3 LAN to WAN 32 packets, WAN to LAN 308 packets

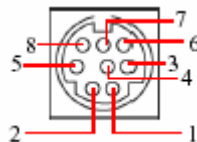
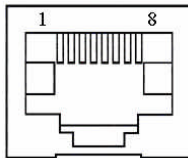
B-12. ET10R Ethernet Router Module

When the **TTU02-MUX** is ordered with an **ET10R Interface**, the unit is not only an access unit for T1, but also becomes a high performance Router for 10Base-T or 100Base-TX Ethernet LAN connection. The **ET10R** utilizes standard pin out on one RJ-45 connector, providing connection to Ethernet (10Base-T) or Fast Ethernet (100Base-TX) networks over UTP (unshielded twisted pair) cabling.



Configuration of the router is beyond the scope of this manual. Please refer to the CDROM based instructions that are included with the router module. The ET10R router module is configured with the **NetDevice Manager** program which is installed under Windows® 95/NT/98/ME/2000. The program is included on the CDROM. Alternately the router may be configured via the RS-232 control port. A special cable must be used to connect to the modules DIN connector. Pinouts are provided below for reference.

MDI
1. Tx +
2. Tx -
3. Rx +
6. Rx -



RS-232
DTE

Specifications

CPU

Hi-Performance 32 bit ARM RISC CPU

Security

PAP, CHAP, MSCHAP, NAT.

Network Protocols

TCP/IP, DHCP, PPP, Frame Relay

DTE Baud rate

Synchronous £ 2M bps

WAN Support

T1/E1

LAN Support

10Base-T / 100Base-TX

Memory

4M bytes DRAM

2M bytes Flash Memory

PIN	Circuit	Direction	Description
1	NC		
2	RX	IN	Receive data
3	TX	OUT	Transmit data
4	NC		
5	GND		Signal ground
6	NC		
7	RTS	OUT	Request to Send
8	CTS	IN	Clear to Send

Table B-13 Console port, RS-232, pin allocation

NOTES:

NOTES:



Access Unit

CTC Union Technologies Co., Ltd.

Far Eastern Vienna Technologies Center
(Neihu Technology Park)

8F, No. 60, Zhouzi St., Neihu, Taipei, Taiwan

Phone: (886) 2.2659.1021 Fax: (886) 2.2799.1355

E-mail: info@ctcu.com

<http://www.ctcu.com>